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PROGRESS REPORT INTERSTATE POLLUTION CONTROL PROGRAM LOWER MISSOURI RIVER YANKTON, SOUTH DAKOTA, TO ST. LOUIS, MISSOURI 1957 - 1958

PUBLIC HEALTH SERVICE
KANSAS CITY, MISSOURI

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U. S. PUBLIC HEALTH SERVICE
REGION VI
KANSAS CITY, MISSOURI

February, 1959

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PROGRESS REPORT
Interstate Pollution Control Program
Lower Missouri River
Yankton, South Dakota, to St. Louis, Missouri
1957 - 1958

PURPOSE OF REPORT

This report reviews progress in abating interstate pollution along the Lower Missouri River and brings pertinent information up to date. Specifically, it reviews the basis for Public Health Service action by summarizing the joint Federal-State program for pollution abatement, describes the Missouri River Development program and Power operations, presents data for each of the communities and industries adjacent to the River, and analyzes population and industrialization trends. The uses of Missouri River water and effects of pollution are reviewed and the current status of progress towards pollution abatement is reported.

ACKNOWLEDGMENTS

This report was made possible by the cooperation and assistance of various Federal, State and Municipal agencies. Individual acknowledgment is not practicable but all persons are assured that their invaluable aid is sincerely appreciated.

Special recognition is given: State water pollution control agencies of South Dakota, Iowa, Nebraska, Kansas and Missouri; the Corps of Engineers (Omaha, Nebraska, and Kansas City); and the Department of Commerce, Kansas City, Missouri

The study leading to this report benefits from a "project grant" allocated to this Region through action of the Headquarters Office.

A REVIEW OF THE JOINT FEDERAL-STATE ACTION PROGRAM

In July 1956, passage of the "Water Pollution Control Act Amendment of 1956", Public Law 660, strengthened the cooperative State-Federal water pollution control program established in 1948 by Public Law 845. Prior to the passage of these laws, the States as well as the Federal Government had individually and cooperatively worked toward abatement of pollution.

Knowledge of interstate effects of pollution in the Lower Missouri River goes back to 1913 when Dr. A. J. McLaughlin published his report "Sewage Pollution of Interstate and International Waters--The Missouri River from Sioux City to Its Mouth" (Hygienic Laboratory--Bulletin No. 89).

In 1949, the Public Health Service and water pollution control agencies of South Dakota, Iowa, Nebraska, Kansas, and Missouri initiated cooperative surveys and investigations that led to publication of the report, "Lower Missouri River Basin, Water Pollution Investigation, October 1952" (Public Health Service Publication No. 269). In July 1953, a "Comprehensive Program for Control of Water Pollution--Missouri Drainage Basin" was adopted by the Basin States and the Public Health Service.

This program, supported by field investigations, outlined the basic steps for pollution control in the basin. State water pollution control agencies and the Public Health Service reached agreement on: Sources of pollution; water quality objectives; water uses to be protected; and

projects required to abate pollution. The Missouri Basin Inter-Agency Committee [1/] endorsed the Water Pollution Control Comprehensive Program as an integral part of the total water resources program for the basin. Each year the MBIAC has re-affirmed its concurrence in its "Annual Operation Plan of Missouri River Main Stem Reservoirs".

Following a series of meetings of the five States in the Lower Missouri Basin, the Public Health Service called a meeting in Omaha, Nebraska, on November 15, 1953, with the result that a "Uniform Program for Abatement of Interstate Pollution in the Main Stem, Lower Missouri River" was adopted by the States and the Public Health Service. Under this program, each State agreed to notify in January 1954 the municipalities and industries of the pollution abatement programs of the State and Federal Governments and to initiate, within the framework of their normal operations, a program geared to obtain award of treatment plant contracts by 1959. Since that time, States have submitted periodic progress reports on pollution abatement to the Public Health Service.

Section 8 of P. L. 660 gave the Public Health Service certain responsibility relating to enforcement actions concerning pollution of interstate waters. As a result of reports, surveys or studies, or at the request of a State, the Surgeon General may call a conference if he believes that interstate pollution exists. If, at the conclusion of such

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1/ Membership of the Missouri Basin Inter-Agency Committee consists of the Governors of the ten Basin States and representatives of seven Federal Agencies (Department of Agriculture; Corps of Engineers; Department of Commerce; Department of Health, Education, and Welfare; Department of Interior; Department of Labor; and the Federal Power Commission).

a conference, or any time thereafter (minimum of 6 months), effective progress toward pollution abatement is not being made, a public hearing may be called by the Surgeon General. Again, if action is not taken within a reasonable time to secure pollution abatement (minimum of 6 months), the Secretary of the Department of Health, Education, and Welfare may request the Attorney General of the United States to bring action on behalf of the United States to secure abatement of the pollution.

Public Law 660 provides for protection of interstate waters through enforcement proceedings, and assistance to municipalities through a grant of Federal monies for construction of sewage treatment facilities. A grant may cover up to thirty per cent of the cost of a project but may not exceed $250,000. The law also provides for grants to State and interstate water pollution control agencies for strengthening their programs. Other aspects of the law aimed at controlling pollution provide for collection of basic data on water quality, and for technical assistance and research.

THE MISSOURI RIVER DEVELOPMENT PROGRAM AND RIVER OPERATIONS

Control of discharge in the Missouri River began in 1938 with closure of Ft. Peck Dam, which regulated flows but did not prevent flooding of lower reaches. Since 1844, some thirteen major floods occurred in the Missouri River Basin resulting in the loss of many lives and billions of dollars of property damage. Three of the last major inundations, 1943, 1947, and 1951, have cost over $1.4 billion in damages.

Harnessing of the river proceeded with closure of Ft. Randall Dam in July 1952. Further control was realized in 1954 and 1955 when Garrison and Gavins Point Reservoirs were put into operation. Additional control has been provided by Oahe Reservoir, whose closure was effected in August 1958.

Beginning in 1953, the Missouri Basin Inter-Agency Committee formulated an annual projection of main stem reservoir operations as a means of coordination with Federal, State, and local interests. Water in the reservoirs is released to maintain requirements for flood control, irrigation, navigation, power production, water supply and stream sanitation, and other functions. During winter months, releases consider needs for water supplies and dilution of sewage. Supplementary releases will be made for only an interim period consistent with reasonable progress on sewage treatment by communities and associated industries now discharging raw wastes to the river. Since water for sanitation is not, by law, a legitimate water use, this arrangement was agreed upon for a period ending approximately in 1961.

In April 1951, the Missouri Basin Inter-Agency Committee published a report on "Adequacy of Flows in the Missouri River" in which the Public Health Service presented data on water requirements for municipal water supply and stream sanitation. Minimum flows required for these purposes were outlined and have been accepted and used to govern release of water, particularly during winter months.

Since main stem reservoirs have been in operation, water treatment plants have found that the chemical quality of the water has generally

improved. Turbidity and hardness have decreased and become more uniform. Previously concentration varied over a wide range.

While chemical quality of water is of utmost importance, physical quality also has a definite place in all uses of the Missouri River. Uses of the Missouri for domestic and industrial water supply, recreation, commercial fishing and navigation are directly influenced by community growth and industrialization. As a community grows and industry expands, so does the pollutional load that the river must carry. This, in turn, affects all uses of river water.

CITIES AND ASSOCIATED INDUSTRIES

Yankton, South Dakota

Location: Approximately 840 miles above the mouth of the Missouri and 4 miles below Gavins Point Reservoir.

Population: 1950, 7,709; estimated 1957, 9,500. East Yankton and the State mental hospital add approximately 3,000 people, giving a total 1957 estimate of 12,500. There has been no significant industrial growth to account for the increased population.

Garbage Disposal: Accomplished by means of an open dump outside the city limits. The city owns two sites that may be used as sanitary land fills. No method of financing has been proposed to date but the city will probably go to "fill" disposal of garbage. Residents are charged a fee of 75¢ per month for this service.

Water Supply: Taken from the Missouri River. Average 1957 consumption--858,000 GPD, 333,000 GPD for domestic purposes and 525,000 GPD

for commercial and industrial uses. During August 1957, average use was 1,546,000 gallons per day.

Sewage Facilities: No sewage treatment facilities exist. The city, by means of a revolving fund (monies left over from tolls on the Missouri River Bridge) has secured a preliminary engineering report. Application for a Federal grant has been made and approved pending acquisition of a site and State approval of plans and specifications. Total cost of the project, treatment plant and outfall sewer, is estimated at $352,500. Of this amount, $202,435 will be obtained by revenue bonds, $42,565 from the State of South Dakota in payment of the State hospital's share, and $105,000 from Federal funds. The application for Federal funds provides for award of contract about July 1, 1959.

Yankton had an assessed valuation (1955) of over 27 million dollars and a bonded indebtedness (January 1, 1957) of $80,000.

Vermillion, South Dakota

The city uses wells as a source of water supply and has no sewage treatment facilities. However, the city does have a preliminary engineering report and has applied for Federal funds. This application indicates Vermillion will be ready to call for bids for sewage treatment facilities in April 1959. Cost for construction of a sewage lagoon has been estimated at $125,975. Vermillion is not included in any summations, data presentation or conclusions presented in this report.

Elk Point, South Dakota

Population: 1950, 1,367; 1957 estimate, 1,400. The city has had

practically no industrial expansion although a company that manufactures truck bodies and employs 5-3 persons has recently been established.

Garbage Disposal: Collected and hauled to an open dump. Service charge is 50¢ per month.

Water Supply: Two wells supply an average use of 70,000 gallons per day.

Sewage Facilities: Construction of sewage treatment facilities is now in progress. A preliminary engineering report estimated the total cost of treatment facilities to be $92,855. A Federal grant of P. L. 660 monies was requested and approved for $27,856. Construction of a sewage lagoon was underway in July 1958, and the remainder of the system has been contracted. A city ordinance, appropriating $65,000 for 20-year sewer improvement bonds was approved on September 13, 1957. Payment of these bonds will be made by tax levies each year.

Ponca, Nebraska

The city uses wells as a source of water supply and has no sewage treatment facilities. Ponca is not included in any summations, data presentations, or conclusions appearing in this report.

South Sioux City, Nebraska

Population: 1950, 5,557; 1957 estimate, 7,200. Some population growth may be attributed to development of two commercial fertilizer manufacturing plants and two ready-mix concrete plants. A large part of the population increase resulted from establishment of residences by persons normally employed in Sioux City, Iowa.

Garbage Disposal: The city now operates an open dump along the Missouri River. Plans are on hand for placing a sanitary land fill in operation east of the Combination Bridge.

Water Supply: Three wells supply an estimated 5,500 persons with 400,000 gallons of water per day.

Sewage Facilities: A sewer service charge of 50¢ per month is collected from residents. Commercial establishments pay a prorated amount dependent on the type of business. For example, charges for barber shops are based on the number of chairs. An engineer has been engaged to prepare a preliminary report on sewage treatment and the city is looking for a location to build the necessary facilities.

During the year ending July 31, 1957, the city collected over $11,000 in sewer fees. Total receipts for the year amounted to over $625,000.

Sioux City, Iowa

Population: 1950, 83,391; 1957 estimate, 87,000. There has been a slight increase in over-all employment in the city during the past five years. The closing of Cudahy Packing Company in 1954 and reductions in force at Ray-O-Vac Batteries offset employment increases in other firms and lines. Some rather sparsely populated areas have been annexed.

Sixty-four firms each employ over 50 people. Three new establishments with more than 50 employees each, two feed plants and a meat processor, have opened since 1957.

Garbage Disposal: A free city garbage collection service is in operation. Refuse is hauled to a sanitary land fill north of the city.

Water Supply: Twelve wells supplied an average of 10.33 million gallons per day during 1957.

Sewage Facilities: A sewer rental fee taxes residences one-half the minimum water rate based on a quarterly billing or $2.12 per 4 months, and commercial establishments one-half the water rate for one month or $1.02 per month.

By council resolution on November 17, 1955, the city pledged itself to a program of planning, financing and constructing treatment facilities. In line with this resolution, the city hired a firm of consulting engineers to prepare a preliminary report on treatment facilities. Estimated cost of the proposed plan is $7,100,000. Following election of a new city council (city manager-council government), the proposed schedule has been delayed. While the new council has approved construction of some interceptor sewers, it passed a resolution March 31, 1958, that negates the 1955 pledge and indefinitely postpones construction of sewage treatment facilities.

At a conference called by the Surgeon General of the Public Health Service, July 24, 1958, with representatives of the Public Health Service and five States in the Lower Missouri Basin as conferees, a time schedule for remedial action was established for Sioux City and its associated industries. The first of the city's construction contracts is to be awarded by September 1, 1959. The legal counsel

for the city stated, however, that city officials did not believe Sioux City was polluting the river subject to abatement under P. L. 660 and that construction of remedial waste treatment facilities was not economically feasible.

During 1956 the sewer rental fund acquired $95,500 of the city's $5 million receipts. The city's general bonded indebtedness amounts to $3,923,965.

Dakota City, Nebraska

Population: 1950, 622; 1957 estimate, 750. There are no major industries in Dakota City, and the moderate population increase over the 7-year period probably resulted from normal growth and a slight overflow from Sioux City, Iowa, and South Sioux City, Nebraska.

Water Supply: Two wells supply water for the city's inhabitants. Meters were installed early in 1958. Previously a $1.50 flat rate was charged.

Sewage Facilities: The city lacks a preliminary engineering report and has no plans for sewage treatment in the immediate future.

Blair, Nebraska

Population: 1950, 3,815; 1957 estimate, 4,350. Some small factories, employing 10-25 people each, have been established in the city during the past few years. Blair has no large industries except a farm equipment manufacturer employing 100-200 people.

Garbage Disposal: Private garbage collectors haul the refuse to an open dump south of the city.

Water Supply: Four wells supplied 258,000 GPD during 1957.

Sewage Facilities: A primary sewage treatment plant now under construction will cost about $147,900. The city has received a P. L. 660 grant of $44,370, and will finance the remaining cost by general obligation bonds.

Dana College in Blair treats its wastes with Imhoff tanks. All industrial wastes go to city sewers.

Carter Lake, Iowa

Population: 1950, 1,183; 1957 estimate, 1,300. The city has a peculiar geographical location. It was separated from Iowa when the Missouri River changed its course, and is now completely fenced in by Nebraska communities on the landward side. Hence, growth by annexation is impossible. Several comparatively large industries are located in Carter Lake, a gasoline pipe line company, gasoline transportation company, a store fixture manufacturer, and, the largest, a steel company. No new industry has developed in the past few years.

Garbage Disposal: Garbage is collected by a private individual and hauled to a dump in East Omaha.

Water Supply: While legally an Iowa community, Carter Lake purchases its water from the Omaha Metropolitan Utilities District. During 1957 average daily consumption was 54,600 gallons.

Sewage Facilities: The city lacks treatment facilities, and the sewer system discharges directly to the Missouri River. No definite plans have been made for treatment although connection with the Omaha system is considered feasible when proposed interceptors are completed. Planning by Omaha includes provision for this connection.

Six hundred dollars were collected for sewer permits during 1957. Total receipts of $66,926 and total expenditures of $74,470 represent the city's financial operations in 1957.

Council Bluffs, Iowa

Population: 1950, 45,429; 1957 estimate, 53,000. This increase does not reflect significant industrial expansion, but rather movement of Omaha workers across the river. The city does have several large industries, e.g., railroad yards, but they are not new developments. Smaller industries that have moved to the city in the past 4 or 5 years cannot account for the population increase.

Garbage Disposal: The city charges $10.50 per year for garbage collection. Refuse is hauled to a sanitary land fill.

Water Supply: The major source of supply is the Missouri River. Water from one well may supplement or blend with the river water. During 1957, average use was 4.1 mgd, 2.1 mgd for domestic and 2.0 mgd for industrial uses.

Sewage Facilities: Sewage treatment facilities are lacking. A complete engineering report, including construction plans and specifications, prepared several years ago may have to be revised before construction of any treatment works can begin. At the present time, the city has no plans for moving ahead with abatement, but officials have promised the State Health Department that they will act in accord with their neighboring city of Omaha.

During 1957, the city operated on a $2.5 million budget, of which $250,000 was expended on sanitation.

Omaha, Nebraska

Population: According to a national survey, Omaha is the fourth fastest growing industrial city in the nation. Population increased from 251,117 in 1950 to about 300,000 in 1957. Annexation has increased the number of people by about 12,000, but major growth has resulted from expanding industry.

Garbage Disposal: Installation of a garbage incinerator shows marked progress over the uncontrolled dumps that existed in 1952. The 375 ton per day incinerator is being bought on a 10-year deferred payment plan It will probably be enlarged in 3 or 4 years. Tin cans are reclaimed under contract, the metal being used for precipitating purposes by copper industries.

Water Supply: Omaha obtains its water from the Missouri River. During 1957, an average of 47.4 mgd were used by the city and communities to whom the water is sold. Of this total, 15.2 million gallons were used for domestic, 15.9 million for commercial, and 16.3 million gallons for industrial purposes. These figures indicate the extent of industrialization. During August 1957, the city used 25 per cent more water than the daily average during the year--66.6 mgd.

Sewage Facilities: Approximately one-third of the city sewage is treated at the Papillion Creek plant. This activated sludge plant has a 6 mgd capacity and is now being enlarged to handle twice this volume. Cost of the addition is slightly over $2 million, and P. L. 660 funds will contribute $250,000. Plans call for interceptor sewers to cut off present raw sewage outlets to the Missouri River and carry the sewage

to a downstream treatment facility. Total cost of all projects for pollution abatement, including the Papillion Creek expansion, is approximately $18 million.

A number of revenue sources will be utilized to subsidize abatement facilities. A $3 million bond issue, already enacted, will finance enlargement of the Papio Creek plant. Other abatement works will be financed by general obligation bonds and a sewer use fee, the last source already in operation.

Under the sewer service charge, the city has approximately 80,000 domestic accounts (individual homes). Another 10-15,000 accounts are collected from the city environs. Individual homes are charged 80¢ per month for sewer use. Multiple housing unit charges are based on water rates--$1.00 per month for the first 500 cubic feet plus 25 per cent of the cost of the water used in excess of 500 cubic feet. Commercial and industrial establishments are charged $1.00 per month plus 15 per cent of the cost of water used in excess of 500 cubic feet. The total cost per year for commercial and industrial establishments may not exceed an amount equal to a 3 mill tax levy on their assessed real property value if the firm is located within the corporate limits of the city. Firms outside the city limits that use city sewers may be charged up to a 4½ mill levy on their assessed real property.

A bond election on June 17, 1958, for issuance of general obligation bonds to be paid by tax levy, and revenue bonds to be paid by the sewer service charge, was defeated by a 3 to 1 margin. On November 4, 1958, a proposal for issuance of $8,000,000 in sewer bonds was passed

by the voters. The bonds will provide for internal sewer improvements and construction of the North Omaha interceptor and afford construction plans and specifications for the balance of the interceptor sewer and treatment plant. This interceptor will collect sewage from the northern edge of the city and carry it down near the central business district for discharge to the Missouri River. Another election, tentatively scheduled for 1960, and so announced prior to the 1958 election, will be necessary to provide for construction of the sewage treatment plant and remaining facilities.

At a conference on June 14, 1957, called by the Surgeon General of the Public Health Service, it was determined that pollution from Omaha and the surrounding area is endangering the health and welfare of persons downstream from the sources. In view of these findings, Omaha was instructed to prepare plans for abatement and have all remedial facilities under construction by 1960.

Bellevue, Nebraska

Population: 1950, 3,858; 1957 estimate, 7,500. This large increase is attributed to growth of Offutt Air Base, Headquarters of the Strategic Air Command, with attendant increase in number of personnel quartered off-base. Rapid turnover, 60 to 100 Air Base families per month, has little effect, as families move in immediately to replace those that leave. A small portion of the increase may be ascribed to Omaha workers residing in Bellevue, and to establishment of a chemical plant at nearby La Platte, Nebraska. A 1954 school

survey indicated a population of 5,500 and the average age of homeowner to be 34.

Garbage Disposal: Collection by a private firm; disposal to city owned facilities.

Water Supply: Two wells supply an average of 0.6 mgd. Planning is under way for an additional well to be used on a stand-by basis. Construction of a 750,000 gallon reservoir was completed in 1957.

Sewage Facilities: Bellevue has no sewage treatment facilities. An engineering firm has been engaged to prepare a preliminary report and the city has made application for financial aid under The Public Health Service Construction Grants program. This application indicates contracts are to be awarded in Fiscal Year 1960.

With comparatively large expansion of the city, plans for sewering new additions constitute much of the sewer program. A December 1956 ordinance authorized a sewer service charge. Residences are charged 50¢ per month. Multiple housing units of over three families, apartments, and trailer courts pay 25¢ per month per unit. Commercial establishments pay a $1.00 sewer use charge.

Plattsmouth, Nebraska

Population: 1950, 4,874; 1957 estimate 5,500. Growth of this town also reflects influences of Offutt Air Base personnel. Some increase may be attributed to opening of the chemical plant at La Platte.

Garbage Disposal: A private firm hauls refuse to a city owned open dump.

Water Supply: Two wells supplied about 370,600 gallons per day during 1957. Railroad shops are the largest industrial users.

Sewage Facilities: A preliminary report on sewage treatment has been prepared by consulting engineers. The city has prepared an application for financial aid under the Public Health Service Construction Grants program. It is indicated that contracts for sewage treatment works will be awarded in Fiscal Year 1960. No method of financing has been established, although a 1 mill tax levied in 1957 for a sewer improvement sinking fund accumulated revenue estimated at $4,435. This amount will be doubled during 1958 with the tax levy increased to 2 mills. Estimated cost of treatment is about $217,000. Acquisition of the proposed plant site has contributed to delay in construction.

Nebraska City, Nebraska

Population: 1950, 6,872; 1957 estimate, 7,500. Increase is largely attributed to industrial expansion and normal growth. A food cannery, the largest industry in the city, employs 385 persons during its peak season. A meter company opened in 1952 and now employs some 235 persons. One new addition was annexed by the city during the past five years, but this area did not account for any appreciable population growth.

Garbage Disposal: Private collectors haul refuse north of the city to a type of a sanitary land fill that is covered occasionally with dirt.

Water Supply: In April 1957, three wells replaced the Missouri River as a source of water supply. The river had been used for 69 years, but the old system had become antiquated and inadequate, and it became necessary to add greater capacity or find another source of water. Because of inherent problems in treating Missouri River water, a well supply was deemed advisable. A softening plant was built and placed in operation, along with a new 750,000 gallon elevated reservoir. During 1957, water was consumed at a rate of 1.03 mgd.

Sewage Facilities: The city has a consulting engineer's preliminary report on sewage treatment facilities and has prepared an application for financial aid under the Public Health Service Construction Grants program. It is indicated that contracts for sewage treatment works will be awarded in Fiscal Year 1960. A report on methods of financing the proposed abatement works was to be completed by February 15, 1958. In view of current plans for other projects in Nebraska City, construction of treatment facilities will probably not begin until 1960. The city is currently paying $120,000 of sewer bonds for a trunk line.

St. Joseph, Missouri

Population: 1950, 78,588; 1957 estimate, 85,000 (total metropolitan area 100,000). A large part of the population increase is due to industrial expansion and growth. Several comparatively large industries have established business in the past few years and other companies have enlarged. St. Joseph ranks seventh in the nation for sale of livestock. The packing industry, with 3,800 employees, is the largest in the city.

Garbage Disposal: Garbage disposal is accomplished under a lease with the St. Joseph Sanitation Commission which received $88,800 during the Fiscal Year ending April 14, 1957. Garbage is hauled to a sanitary land fill.

Water Supply: Raw water is drawn from the Missouri River. During 1957, average use was 10.6 mgd. Of this amount, 2.4 million gallons went for domestic requirements, 5.2 million gallons for industrial use, and 3.0 million gallons for commercial purposes. These factors indicate the industrialized nature of St. Joseph, as industry consumed nearly as much water as domestic and commercial users combined.

Sewage Facilities: On June 11, 1957, the Surgeon General of the Public Health Service called a conference at St. Joseph for the purpose of establishing a time schedule for Missouri River sewage pollution abatement. The conference established a program of remedial measures, the first step to be submission of a program for financing the proposed waste treatment facility to the voters on November 12, 1957. The city defaulted and did not maintain the November date, but, after a vigorous campaign for passage of the bond issue, an election was held on March 4, 1958. A majority of votes were cast in favor of the $9,150,000 revenue bond issue for treatment facilities, but the measure was defeated as it did not receive a four-sevenths majority required for approval. The State Division of Health has since curtailed FHA and GI loans by refusing to approve sewer extensions which are requisite for approval of these loans.

Under the proposed financing plan, homeowners were not required to pay the entire cost of treatment facilities. The stockyards industry agreed to pay $1 million toward construction of the treatment plant and 50 per cent of its subsequent cost of operation. Residences would be charged a sewer use fee based on water consumption--average fees to be from $1.45 to $2.00 a month.

All agreement on financial participation in treatment facilities by industry outside the city limits terminated with defeat in the March 4th election. Negotiations are again under way for industry participation. The city has indicated that a re-election may be held early in 1959.

Atchison, Kansas

Population: 1950, 12,792; 1957 estimate, 13,240. The population increase is mainly due to normal growth. No large manufacturing industries have established businesses in Atchison for the past 4 to 5 years. The city's largest employer is a manufacturer of locomotive parts, steel, brass, and bronze castings, and other equipment. This firm now employs about 900 persons. Four other establishments have over 100 employees, and the remainder hire less than 100 persons each.

Garbage Disposal: This duty is accomplished by means of a sanitary land fill west of the city.

Water Supply: During 1957, Atchison used an average of 2.25 mgd, drawn from the Missouri River. During August, usage rose to 2.8 million gallons daily.

Sewage Facilities: A preliminary report on sewage treatment has been prepared, and a plant site has been purchased. The city has adopted an ordinance whereby sewer service charges sufficient to issue revenue bonds for sewage treatment facilities will be initiated in January 1959. Completion of final plans is authorized and scheduled for February 1959 and award of construction contracts are anticipated during 1959.

Leavenworth, Kansas

Population: 1950, 20,543; 1957 estimate, 22,640. No large industries have established business in the area during the past 5 years. Fort Leavenworth with its general command and staff school, the Federal prison, and the Veterans Administration Hospital, located in the surrounding area, are considered to contribute to the normal population growth of the city. Two steel fabricators, with over 200 employees each, are the largest industries in the city. Approximately four other industries employ over 100 people each, and remaining establishments have less than 100 workers each.

Water Supply: Water is obtained from the Missouri River. During 1957, 2.3 million gallons were used daily by the city and environs. During August, the daily use increased by 1 million gallons.

Sewage Facilities: The city had complete construction plans for sewage treatment completed nearly four years ago. The State Health Department approved plans at that time, but, because of population increases and additional waste load, some slight modifications are necessary. The city recently authorized its engineers to bring cost data up to date. A meeting with Federal agencies in the area to

allocate costs for use of municipal facilities is scheduled prior to February 1, 1949. Leavenworth is planning to apply for Fiscal Year 1960 Federal grant funds with a construction contract to be let in the fall of 1959.

Wadsworth, Kansas

Population: The Veterans Administration Hospital which comprises Wadsworth will be used as an example of all Federal installations in the Leavenworth area. By its nature, Wadsworth has a transient population. During 1957, the population of the installation was estimated to be 3,500, of which 1,500 were employees, 1,700 patients and members, and 300 wives and families. Population dropped slightly since 1950, however, it remains fairly constant.

Water Supply: Water is purchased from the City of Leavenworth. All utilities within the limits of the hospital are owned by the Government with non-federal organizations furnishing pipe lines, etc., up to the limits of the hospital.

Sewage Facilities: When the City of Leavenworth constructs its sewage treatment plant, wastes from the Wadsworth hospital will be included.

Kansas City, Kansas

Population: 1950, 129,553; 1957 estimate, 140,000. About 10,000 people were incorporated by annexation since 1952. Industrial expansion has accounted for some increase. The five township area which includes Bonner Springs, has 191,000 people.

Garbage Disposal: Garbage disposal is done under contract and hauled to sanitary land fills. The 1957 contract cost was $244,500.

Water Supply: Water for the city and environs is obtained from the Missouri River. During 1957, use averaged 24.5 mgd--9.3 million gallons were for domestic or residential requirements, 2.9 million gallons for commercial purposes, and 12.3 million gallons for industrial use. The last figure indicates the highly industrialized nature of the city. During August, consumption was 29.8 mgd.

Sewage Facilities: In response to an order issued by the Kansas State Board of Health, the city contracted preparation of a preliminary engineering report on sewage treatment. This report was completed in 1953 and estimated the cost of treatment plants, separation of storm and sanitary sewage, and other related abatement works at $20,714,000. In November 1955, the city voted $3.7 million for construction of interceptor sewers and purchase of land. This program is under way. A re-study of the preliminary report is also in progress.

On December 3, 1957, the Surgeon General called a conference at Kansas City, Missouri, on pollution emanating from the Kansas City metropolitan area. It was determined that construction contracts for remedial works be let by Kansas City, Kansas, not later than January 1, 1960, and that treatment works be in operation by March 1, 1962. However, complete separation of storm and sanitary sewage may not be effected until January 1, 1963.

North Kansas City, Missouri

Population: 1950, 3,886; 1957 estimate 5,400. The indicated increase was probably due to normal growth of the community. North Kansas City

cannot grow by annexation since it is surrounded by Kansas City North, an incorporated part of Kansas City, Missouri. The residential population of North Kansas City is small compared to the amount of industrialization. Some in-plant expansion and development of small businesses has occurred.

Garbage Disposal: This activity is handled by contract with a private firm. Refuse is hauled to a sanitary land fill beyond the city limits.

Water Supply: Three wells supply an average of 2 mgd.

Sewage Facilities: Sewage is not treated. A consulting engineering firm submitted a preliminary report on sewage treatment in November 1957. This report has been approved by the State Division of Health, and an election to finance construction is tentatively scheduled for early 1959. No sewer rental fee is charged at present.

At a P. L. 660 conference held December 3, 1957, on pollution from the Kansas City metropolitan area, North Kansas City was instructed to let contracts for construction of treatment facilities not later than June 1, 1960. Methods of financing treatment facilities are to be presented to the voters not later than September 1, 1959.

Kansas City, Missouri

Population: 1950, 456,622; 1957 estimate, 500,000. Approximately 12,000 people were added in 1957 by annexation of an area to the southeast of the city. Expansion of some industry and addition of others may account for a substantial part of the gain.

Garbage Disposal: Residential garbage disposal for the city is by means of sanitary land fills. Garbage from commercial establishments

is fed to hogs, the unconsumed portion along with manure from the pens being hauled to land fills. The sanitary land fills are located along the banks of the Missouri River near the Choteau Bridge. Residents pay no charge for collection service.

Water Supply: Water is obtained from the Missouri River. The facility serves Kansas City, Missouri, Kansas City North, the municipal airport, the Ford Motor Company, and various smaller communities. During 1957, the Kansas City, Missouri, treatment plant turned out more water than any municipal plant drawing from the Lower Missouri River. Average use was 77.9 mgd. During August usage exceeded 100 mgd.

Sewage Facilities: On December 3, 1957, the Surgeon General called a conference on interstate pollution caused by untreated waste discharges from the Kansas City Metropolitan Area. The conference agreed that Kansas City, Missouri, should let contracts for construction beginning not later than January 1, 1960. The city assigned two firms of consulting engineers to prepare preliminary reports on sewage treatment.

These reports have bern presented to the city and are now under consideration by the State. Industries in the area will be permitted to discharge directly to city treatment facilities provided that deleterious or injurious materials are reduced or eliminated by in-plant control. Industries having separate outlets to the River have pledged their support of the program and will provide their own treatment or use municipal facilities in line with the time schedule established at the conference on December 3 and agreed to by the conferees and city officials.

Some treatment of sewage already exists, particularly in the new housing developments on the southern edge of the city limits. Developers have constructed small conventional treatment plants or lagoons. The practice of feeding residential garbage to hogs was stopped in 1955.

A sewer service charge has been established to obtain funds for the city's pollution abatement program. Residential rates are 32 per cent of the average of the two water bills after January 1 of each year (bimonthly billing). The minimum amount residential users would pay is 30¢ per month. Commercial and industrial establishments pay 17 per cent of each month's water bill (minimum of 70¢ per month) with rates varying depending on water used for air conditioning, etc.

Independence, Missouri

Population: 1950, 36,963; 1957 estimate, 48,000; growth occasioned by urban expansion and annexation. Industries have increased about 20 per cent over the past five years.

Garbage Collection: Contracted garbage collection, free to residents, cost $84,600 during the Fiscal Year ending March 31, 1958. Garbage is cooked and fed to hogs.

Water Supply: Well water is treated prior to distribution. About 77,000 persons are served an average of 5.4 mgd.

Sewage Facilities: Approximately 50 per cent of city sewage goes to a secondary treatment plant. No sewer service charge is made except through general taxation. An engineering report has been approved by

the State and financing of additional facilities was approved by voters November 24, 1958. Start of actual construction during 1959 seems assured.

During the last Fiscal Year, $92,000 of the city's $380,000 budget was expended by the sewer department and treatment plant.

Lexington, Missouri

Population: 1950, 5,074; 1957 estimate, 5,100. Lexington employs about 1,600 people largely in the retail trade market.

Garbage Disposal: Free pickup service conveys refuse to a sanitary land fill.

Water Supply: A private water company treats Missouri River water. During 1957 average consumption of 240,000 gpd were divided as follows: 144,000 gpd to residences; 83,000 gpd to commercial use, and 13,000 gpd to industries.

Sewage Facilities: Lexington lacks preliminary plans for sewage treatment and an approved method of financing. However, a possible plant site is owned by the city. City officials believe that a method of financing may be worked out during 1958. A $430,000 bond issue for sewer extensions furnished connections to 90 per cent of the residents. Wentworth Military Academy, now connected to the municipal system, will presumably have its sewage treated at the municipal plant.

The city does not operate on a formal budget but on a month to month basis.

Waverly, Missouri

Population: 1950, 809; 1957 estimate, 800.

Garbage Disposal: Individual householders may use an open dump or otherwise dispose of their own garbage and refuse.

Water Supply: Three wells supply an average of 20,000 gpd.

Sewage Facilities: The city has no definite plans for sewage treatment, and has not contracted preliminary engineering studies. It owns land that may provide a treatment plant site.

Glasgow, Missouri

Population: 1950, 1,440; 1957 estimate, 1,450.

Garbage Disposal: Residents are permitted to haul refuse to a city owned dump.

Water Supply: The Missouri River supplied an average of 68,000 gpd during 1957.

Sewage Facilities: About 95 per cent of residents are connected to sewers. No studies have been made, and no plans exist for construction of treatment facilities. The city has no formal budget and operates on a month to month basis.

Boonville, Missouri

Population: 1950, 6,686; 1957 estimate, 7,000. This growth reflects, in part, some small industrial expansion.

Garbage Disposal: A city-wide garbage collection system is in operation, and the refuse is hauled to a sanitary land fill.

Water Supply: Water is obtained from the Missouri River. During 1957, average use was 699,000 gpd.

Sewage Facilities: The city has no definite plans or preliminary engineering studies for sewage treatment. A municipally owned site east of the city, now used as a sanitary land fill, may possibly serve as a treatment plant site. Some commercial firms have private outlets to the river but most discharge their wastes to city sewers. No significant enlargements of the city's system have occurred in the past few years.

During the last Fiscal Year (April 1, 1957 - April 1, 1958) the city operated on a $191,000 budget and expended $3,000 to $4,000 on sewer work.

Jefferson City, Missouri

Population: 1950, 25,099; 1957 estimate, 34,000. Some new industry and normal growth account for the increase. Established industry has expanded production during the past five years.

Garbage Disposal: Private collectors haul refuse and garbage to an open dump 8 miles outside the city limits.

Water Supply: Missouri River water was treated at an average rate of 1.4 mgd during 1957. Of this amount, 0.8 million gallons went for domestic purposes, 0.5 million gallons to commercial firms, and 0.1 million gallons for industrial use.

Sewage Facilities: About 4,000 residents are served by a lagoon constructed in 1950. Preliminary plans to treat sewage from the rest of the city have been prepared by consulting engineers. The city does not own a suitable site, nor has it devised a method of

financing treatment works. Approximately 30,000 people are now served by city sewers.

The city's bonded indebtedness is $711,000.

Hermann, Missouri

Population: 1950, 2,523; 1957 estimate, 2,800. Industries are relatively small. A cheese factory and a shoe factory each use over 30,000 gallons of water per month. Two additional industries with a total of 30 employees have established plants in the past two years.

Garbage Disposal: Private collectors haul garbage and refuse to an open dump maintained by the city.

Water Supply: Two wells served 2,500 people an average of 158,000 gpd in 1957.

Sewage Facilities: Approximately 90 per cent of the city is now served by sewers, but no plans exist for sewage treatment, and city officials anticipate no action in the immediate future.

Washington, Missouri

Population: 1950, 6,850; 1957 estimate, 7,500. There are only two large industries in the city, both shoe factories, employing a total of 1,250 people. Three medium sized industries, manufacturers of: corn cob and hickory pipes, refrigeration controls, and milk coolers and milking systems, each employ about 90 people.

Garbage Disposal: Collection is by contract with a private firm and disposal is to an open dump on the banks of the Missouri River in the heart of the city. This contract consumed $6,800 during the final 6 months of 1957.

Water Supply: Water is obtained from 3 wells that supplied 440,000 gpd during 1957.

Sewage Facilities: The city has a preliminary engineering report prepared by consulting engineers in 1940. No definite plans are under way for construction of treatment facilities. One new subdivision incorporating 90 families and 6 businesses has sewers under construction that will discharge directly to the river.

St. Charles, Missouri

Population: 1950, 14,314; 1957 estimate, 20,600. In part, this increase represents overflow from St. Louis and St. Louis County. There is some large industry in the city and one college. The two largest industries are a corn products company and an aluminum manufacturer.

Garbage Disposal: Garbage disposal is by means of a sanitary land fill north of the city limits.

Water Supply: During 1957, the city used an average of 1.5 mgd from the Missouri River.

Sewage Facilities: Consulting engineers have prepared a preliminary report on sewage treatment. On April 1, 1958, a $376,000 bond election for construction of a lagoon to treat wastes from that portion of the city now discharging to the Mississippi River did not carry. This area incorporates some 2,000 people. However a November 1958 bond issue for this same purpose was successful. Two industries, both reclaiming spent oils and acids, are not included in plans for the rest of the city.

The city operated on a $350,000 budget during 1957 and used some $20,000 for sewer expenses.

St. Louis County (Coldwater Creek), Missouri

Population: There are no 1950 statistics on this area. A preliminary engineering report has been prepared for the Coldwater Creek watershed. From this report and other data, the population was estimated at 90,000 in 1957. The largest industries in the area are an aircraft manufacturer and an automobile assembly plant. A large portion of the area is underdeveloped but is zoned for both industrial and residential growth.

Water Supply: Water for this area and the rest of St. Louis County is obtained from the Missouri and Meramec Rivers. Only that portion obtained from the Missouri River is considered in this report. During 1957 total county use (550,000 people) of Missouri River water averaged 46.7 mgd.

Sewage Facilities: Engineers preparing a report on sewage treatment for the Coldwater Creek watershed estimate cost, including interceptor sewers, to be $5.2 million. This study includes Lambert Field and Naval Air Station. Total design flow for the area is 12.5 million gallons daily.

POPULATIONS

Table 1

	1920	1930	1940	1950	Estimated 1957	Estimated 1975
Yankton, South Dakota	5,024	6,072	6,798	7,709	9,500	12,500
Elk Point, South Dakota	1,470	1,294	1,485	1,367	1,400	1,550
South Sioux City, Nebraska	2,402	3,927	4,556	5,557	7,200	10,750
Sioux City, Iowa	71,227	79,183	82,364	83,991	87,000	100,000
Dakota City, Nebraska	399	417	477	622	750	1,075
Blair, Nebraska	2,702	2,791	3,289	3,815	4,350	6,000
Carter Lake, Iowa			846	1,183	1,600	3,500
Council Bluffs, Iowa	36,162	42,048	41,439	45,429	53,000	77,500
Omaha, Nebraska	191,601	214,006	223,844	251,117	300,000	386,000
Bellevue, Nebraska	695	1,017	1,184	3,858	7,500	15,750
Plattsmouth, Nebraska	4,190	3,793	4,268	4,874	5,500	7,500
Nebraska City, Nebraska	6,279	7,230	7,339	6,872	7,500	8,900
St. Joseph, Missouri	77,939	80,935	75,711	78,588	85,000	100,000
Atchison, Kansas	12,630	13,024	12,648	12,792	13,240	16,000
Leavenworth, Kansas	16,912	17,466	19,220	20,543	22,640	28,500
Wadsworth, Kansas					3,500	4,000
Kansas City, Kansas	101,177	121,857	121,458	129,553	140,000	160,000
North Kansas City, Missouri	870	2,574	2,688	3,886	5,400	7,000
Kansas City, Missouri	324,410	399,746	399,178	456,622	500,000	650,000
Independence, Missouri	11,686	15,296	16,066	36,963	48,000	62,000
Lexington, Missouri	4,695	4,595	5,341	5,074	5,100	5,700
Waverly, Missouri	810	941	876	809	800	900
Glasgow, Missouri	1,351	1,409	1,490	1,440	1,450	1,500
Boonville, Missouri	4,665	6,435	6,089	6,686	7,000	7,500
Jefferson City, Missouri	14,490	21,596	24,268	25,099	34,000	45,000
Hermann, Missouri	1,701	2,063	2,308	2,523	2,800	3,150
Washington, Missouri	3,132	5,918	6,756	6,850	7,500	10,400
St. Louis County, Missouri						
Cold Water Creek Watershed					90,000	160,000
St. Charles, Missouri	8,503	10,491	10,803	14,314	20,600	31,500
Total			1,082,789[1/]	1,218,136[1/]	1,378,830[1/]	1,760,175[1/]
Percentage Increase				12.5%	13.2%	44.5%[2/]
Adjusted percentage to equivalent 10 year period					18.9%	17.8%

1/ Excludes St. Louis County and Wadsworth.
2/ For period 1950-1975.

FACTORS INFLUENCING WATER QUALITY AND WATER USE

Population

From 1950 to 1957, population in the 29 selected communities increased by 13.2 per cent whereas the national growth was 12.9 per cent. From 1940-1950, their growth was 12.5 per cent while national increase was 14.5 per cent. Actual and estimated populations over the period 1920-1957 appear in Table 1.

Industrialization

Industrial employment has been used as an indicator of industrial trends in communities along the lower main stem of the Missouri River. Data from "Employment and Earnings" Annual Supplement Issues, May 1955 and July 1958, Employment for the Metropolitan Area of Omaha, Nebraska, and Kansas City, Missouri, are summarized in Table 2.

Table 2

Total Area Employment, 1,000 Persons

	1950	1951	1952	1953	1954	1955	1956	1957
Omaha, Nebraska	135.7	141.4	143.5	144.9	146.2	149.2	151.1	150.1
Kansas City, Mo.	326.7	350.4	369.5	378.6	367.1	372.0	372.9	367.2

The figures given are for total employment 2/ in the metropolitan area of Omaha 3/ and Kansas City 4/. Omaha experienced an employment

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2/ Includes those people employed in contract construction; manufacturing; transportation and public utilities; wholesale and retail trade; finance; insurance and real estate; Government; service and miscellaneous.

3/ Includes Counties of Douglas and Sarpy, Nebraska, and Pottowattamie, Iowa.

4/ Includes Counties of Johnson and Wyandotte, Kansas, Clay and Jackson, Missouri.

gain of 14,400 persons during the period 1950-57, while Kansas City had a growth of 40,500. These figures indicate increases of 10.6 and 12.4 per cent in number of employed persons in Omaha and Kansas City, respectively. A large increase occurred in both areas in 1951. Employment leveled off but continued to increase through 1956, but decreased slightly during the recession of 1957.

While total employment is important in population growth, manufacturing employment alone gives a better indication of increase in industrial production. Of those industries listed (footnote 2/) manufacturing accounts for nearly all processing.

Table 3

Manufacturing Employment, 1,000 Persons

	1950	1951	1952	1953	1954	1955	1956	1957
Omaha, Nebraska	29.2	30.4	30.5	30.8	31.2	32.3	32.5	32.3
Kansas City, Mo.	90.0	100.0	113.9	121.2	114.2	107.8	102.8	101.5

Table 3 lists the number of employees engaged in manufacturing. In Omaha, employment grew by 3,100, or 10.6 per cent, from 1950 to 1957. Kansas City gained 11,500 employees, a growth of 12.7 per cent, during the same period. In each area manufacturing had the same general trend as total employment.

Water Use

Municipal and Industrial Water Supply

During 1957, over 100 billion gallons of Missouri River wager were used by 15 communities in the reach Yankton, South Dakota, to

St. Louis, Missouri. This annual figure equals a consumption of 282 mgd, or a 14.5 per cent increase over 246 mgd used during 1952. Nebraska City, Nebraska, utilized the river in 1952 5/, but has since gone to wells for water supply.

Principal water supplies taken from the lower main stem, amounts and type of usage in 1957 appear in Table 4. Maximum usage was considerably in excess of average daily consumption of 282 million gallons. During August of 1957, daily use was 365 mgd.

Breakdowns into various types of usage were not available for all communities. In eight communities where such data were available, 40 per cent of the water was used for domestic purposes. Thirty-four per cent was used for industrial and 26 per cent for commercial purposes. These figures give an indication of the size of industries in various communities. In larger communities, St. Joseph, Omaha and Kansas City, more water is used for industrial than for domestic or commercial purposes. As the size of the communities decrease, lesser amounts are used for industrial and more for domestic purposes.

Industrial water pumped directly from the Missouri is not included in the table. The 1952 report 6/ lists 13 industries, 12 power plants and one oil refinery, that obtain water directly from the river. It is estimated that they use a billion gallons of water per day for cooling purposes. A small portion of such water may be used for consumptive purposes.

5/ Lower Missouri River Basin Water Pollution Investigation. Public Health Service Publication No. 269, October 1952, Page 38.
6/ Op. Cit. Page 41.

MISSOURI RIVER WATER CONSUMPTION - 1957[1/]

Table 4

ated ation rved	Total Domestic	Total Commercial	Total Industrial	Average Daily Domestic	Average Daily Commercial	Average Daily Industrial	Daily Average Aug. 1957	Total Monthly Average	Total Daily Average	1957 Total
,500	121,442	191,742[2/]		333	525[2/]		1,546	26,099	858	313,184
,000	5,553,338	5,785,369	5,938,535	15,215	15,850	16,270	66,624	1,439,770	47,335	17,277,242
,000	769,528		720,920[2/]	2,108		1,975[3/]	5,818	124,204	4,083	1,490,448
,500	888,128	1,086,730	1,896,185	2,433	2,977	5,195	14,140	322,587	10,605	3,871,043
,000							2,800	68,492	2,252	821,900
,600							3,258	71,327	2,345	855,922
,900	3,399,921	1,069,836	4,468,793	9,314	2,931	12,244	29,768	744,879	24,489	8,938,550
,000							103,817	2,369,074	77,888	28,428,880
,900	52,697	30,349	4,588	144	83	13	330	7,302	240	87,634
,350							78	2,057	68	24,687
,000							840	21,248	699	254,980
,000	299,661	175,843	52,689	820	482	145	1,671	44,017	1,447	528,193
,000	10,963,754	5,932,069	5,675,300	30,038	16,252	15,549	72,031	1,880,927	61,839	22,571,123
,000							60,308	1,419,112	46,655	17,029,340
,500							1,716	44,467	1,462	533,609
,250				64,405	39,100	51,391	364,745	8,585,562	282,265	103,026,735

ous classifications not available.

MISSOURI RIVER WATER CONSUMPTION - 1957[1/]

Location	Estimated Population Served	Total Domestic	Total Commercial	Total Industrial	Average Daily Domestic	Average Daily Commercial	Average Daily Industrial	Daily Average Aug. 1957	Total Monthly Average
Yankton, S. Dak.	7,500	121,442	191,742[2/]		333	525[2/]		1,546	26,09
Omaha, Nebraska	300,000	5,553,338	5,785,369	5,938,535	15,215	15,850	16,270	66,624	1,439,77
Council Bluffs, Iowa	50,000	769,528		720,920[2/]	2,108		1,975[3/]	5,818	124,20
St. Joseph, Mo.	91,500	888,128	1,086,730	1,896,185	2,433	2,977	5,195	14,140	322,58
*Atchison, Kansas	18,000							2,800	68,49
*Leavenworth, Kansas	23,600							3,258	71,32
Kansas City, Kansas	160,900	3,399,921	1,069,836	4,468,793	9,314	2,931	12,244	29,768	744,87
*Kansas City, Mo.	720,000							103,817	2,369,07
Lexington, Mo.	4,900	52,697	30,349	4,588	144	83	13	330	7,30
*Glasgow, Mo.	1,350							78	2,05
*Boonville, Mo.	6,000							840	21,24
Jefferson City, Missouri	30,000	299,661	175,843	52,689	820	482	145	1,671	44,01
St. Louis, Mo.	285,000	10,963,754	5,932,069	5,675,300	30,038	16,252	15,549	72,031	1,880,92
*St. Louis County Missouri	550,000							60,308	1,419,11
St. Charles, Mo.	12,500							1,716	44,46
Totals	2,261,250				64,405	39,100	51,391	364,745	8,685,56

* Breakdown into various classifications not available.

1/ Thousand Gallons

2/ Includes Industrial

3/ Includes Domestic

Based upon estimated population served and daily average water consumption in the fifteen communities, average per capita use is 125 mgd.

Wildlife and Recreation

Recreational use of the lower Missouri River has become more pronounced in recent years. Sport fishing in the tail waters of Gavins Point Dam has become a popular form of recreation for residents in the upper portion of the lower basin. The popularity of the sport and the quality of fish decreases rapidly with downstream distance. Below the large cities, sport fishing is generally confined to those people in the lower income bracket. Fish from the river below Sioux City, Omaha, St. Joseph, and the Kansas Cities often have a pronounced gassy or kerosene-type taste. Most fish from below these cities fall in the "rough fish" category, with carp the predominant catch.

Commercial fishing has also decreased in recent years due to the poor quality of fish. For example, in the four counties bordering the river below the Kansas Cities, the number of licensed commercial fishermen has decreased by 62 per cent in the years since 1952 7/. Complaints registered with the Conservation Commission indicate the unmarketable nature of tainted fish.

Fishermen also report fouling of nets with toilet paper and slime in areas below large sources of pollution. A great increase of fish

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7/ Transcript of Conference, Kansas City Metropolitan Area, December 3, 1957, Statement of P. G. Barnickol, P. 36.

is expected with stabilization of the river, and, in the opinion of Conservation officials, commercial fishing would become an important source of food and revenue with effective pollution control. 8/

The Missouri River serves as a major waterfowl flyway. Ducks and geese feed on and near the river in their migratory flights. Hunters operating from sand bars on the river are exposed to the inherent danger of polluted water. Some birds become saturated with oil and are unable to fly. 9/ Presumably, floating oil also affects other river wildlife directly as well as being detrimental to their habitat.

With regulation of river flow, pleasure boating and water skiing have become rapidly increasing and popular forms of recreation in recent years. Boating enthusiasts have organized clubs and are constructing boat ramps and docks, particularly near the larger cities. Complaints have been registered with Conservation officials regarding foul odors on the river. In addition to the loss in the river's aesthetic value to boaters and skiers, exposure to the polluted water constitutes a hazard to their health.

An important form of recreation, although not normally classed as a "use" of the river, evolves from its mere existence. Many people derive relaxation and enjoyment from just viewing the mighty Missouri from its bluffs or picnicking near its banks. The aesthetic value of a river unsoiled by floating sewage or foul odors is magnanimous.

8/ Conference at Omaha, Nebraska, June 14, 1957, Statement of James Harlon, P. 34.

9/ Conference at St. Joseph, Missouri, June 11, 1957, Statement of P. G. Barnickol, pp. 22-23.

Recreational use, although increasing rapidly, is still largely undeveloped. In Nebraska, for example, it is estimated that over a half million people live within a practical driving distance for recreation on the Missouri River. The river is the only major body of water in eastern Nebraska and, with development of access areas, it should become a major retreat for these people.

Navigation

Navigation on the Missouri River is still in relative infancy. The River and Harbors Act of 1945 authorized the Missouri River Stabilization and Navigation Project which provides for a stabilized navigation channel 300 feet wide and 9 feet deep from Sioux City to the mouth. By the end of Fiscal Year 1957, the navigable channel was 85 per cent complete between Kansas City and the mouth, 82 per cent complete between Kansas City and Omaha, and 43 per cent complete between Omaha and Sioux City. 10/

Commercial freight hauling on the Missouri, in view of the incomplete channel improvement project, is not of appreciable magnitude at the present time. Freight increased from 1.6 million tons in 1950 to 4.3 million tons in 1956. 11/ Commercial tonnage is expected to increase rapidly with completion of the channel stabilization project.

Navigation is adversely affected by pollution from municipalities located along the Missouri. 12/ "The presence of sewage and industrial

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10/ The Missouri River Development Program, Federal Reserve Bank of Minneapolis, March 1958, P. 34.
11/ Ibid.
12/ Transcript of Conference, Pollution of Interstate Waters, Kansas City Metropolitan Area, December 3, 1951.

waste has adverse effects on the maintenance and operation of river boats, and on health conditions affecting construction workers, barge line crews, and other persons who use the river." 13/ Filter equipment on boats is sometimes clogged with floating oil. Corrosive substances in sewage have substantially decreased the life of boat hulls.

The problem of pollution becomes increasingly important in view of expanding navigation. Completion of the channel stabilization project and more concentrated use of the river for hauling commercial cargo will make the effects of river pollution more pronounced.

COLIFORM TYPE BACTERIA

Coliform-type bacteria serve as indicators of pollution. According to drinking water standards adopted by the Public Health Service and most state health agencies, coliforms may not average more than 5,000 per 100 milliliters during any one month nor exceed more than 5,000 per 100 milliliters in more than 20 per cent of the samples examined during the month, nor exceed more than 20,000 per 100 milliliters in more than 5 per cent of the samples examined in one month.

Table 5 lists the maximum daily concentration for each month along with the average of daily coliform tests during the month for 1955, 1956, and 1957 at water treatment plants located at Omaha, Nebraska, St. Joseph, Missouri, Kansas City, Kansas, and Lexington, Boonville, and St. Louis County, Missouri.

13/ Op. Cit. Statement of Colonel L. E. Laurion, District Engineer, Kansas City District, P. 33.

DATA ON COLIFORM (MPN)

		1955		1956		1957	
		Maximum	Average	Maximum	Average	Maximum	Average
Omaha, Nebraska	January	110,000	11,000	17,000	6,400	7,900	2,900
	February	13,000	4,000	23,000	7,900	5,400	2,900
	March	240,000	52,000	24,000	4,900	16,000	6,700
	April	92,000	19,000	35,000	7,900	24,000	10,000
	May	1,600,000	62,000	92,000	4,900	54,000	40,000
	June	180,000	20,000	70,000	7,000	540,000	61,000
	July	2,400,000	243,000	92,000	13,000	330,000	33,000
	August	92,000	11,000	110,000	4,900	92,000	19,000
	September	54,000	15,000	92,000	10,000	220,000	27,000
	October	54,000	12,000	79,000	11,000	79,000	18,000
	November	35,000	9,100	160,000	33,000	140,000	37,000
	December	5,400	2,000	11,000	4,300	24,000	10,000
St. Joseph, Missouri	January			170,000	21,350	460,000	50,000
	February	>1,100,000	140,000	430,000	7,470	150,000	19,000
	March	460,000	67,000	93,000	37,090	79,000	26,000
	April	540,000	110,000	93,000	49,600	93,000	24,000
	May	350,000	52,000	150,000	61,000	93,000	28,000
	June	>1,600,000	380,000	1,100,000	84,240	49,000	25,000
	July	>1,600,000	170,000	240,000	79,280	93,000	28,000
	August	540,000	52,000	240,000	78,810	43,000	20,000
	September	170,000	45,000	1,100,000	127,900	93,000	25,000
	October	350,000	74,000	150,000	64,670	24,000	19,000
	November	240,000	51,000	460,000	108,800	46,000	24,000
	December	4,900	1,500	240,000	75,000	46,000	20,000
Kansas City, Kansas	January	250,000	54,480	140,000	39,100	920,000	81,300
	February	300,000	61,740	100,000	31,500	170,000	26,760
	March	710,000	86,000	170,000	28,200	350,000	46,480
	April	130,000	45,140	170,000	47,270	110,000	42,790
	May	130,000	44,820	130,000	45,680	240,000	66,850
	June	130,000	37,750	240,000	61,560	1,600,000	185,900
	July	300,000	91,550	1,600,000	252,625	540,000	110,960
	August	300,000	46,230	240,000	53,100	540,000	84,400
	September	300,000	60,190	130,000	34,850	350,000	104,550

		1955		1956		1957	
		Maximum	Average	Maximum	Average	Maximum	Average
Kansas City, Kansas (Continued)	October	300,000	105,000	920,000	88,130	1,600,000	162,570
	November	130,000	72,510	240,000	68,700	540,000	70,000
	December	300,000	51,380	120,000	60,450	540,000	99,904
Lexington, Missouri	January			130,000	40,000	130,000	40,000
	February			110,000	39,000	240,000	35,000
	March	540,000	90,000	540,000	54,000	240,000	62,000
	April	220,000	86,000	95,000	35,000		
	May	540,000	120,000	110,000	58,000		
	June	1,600,000	220,000	540,000	190,000	170,000	54,000
	July	920,000	150,000	920,000	130,000	540,000	120,000
	August	350,000	65,000	240,000	97,000	350,000	130,000
	September	540,000	160,000	170,000	100,000	1,600,000	330,000
	October	220,000	70,000	280,000	109,000	1,100,000	360,000
	November	170,000	77,000	540,000	160,000	1,100,000	158,000
	December	79,000	28,000	170,000	70,000	1,100,000	243,000
Boonville, Missouri	January			70,000	18,000	130,000	15,000
	February	240,000	56,000	280,000	40,000	49,000	11,000
	March	240,000	51,000	140,000	24,000	130,000	25,000
	April	220,000	26,000	240,000	52,000	540,000	46,000
	May	240,000	49,000	350,000	48,000	540,000	55,000
	June	280,000	61,000	1,600,000	100,000	920,000	140,000
	July	920,000	90,000	540,000	73,000	1,600,000	230,000
	August	240,000	50,000	920,000	89,000	240,000	47,000
	September	540,000	60,000	160,000	34,000	920,000	130,000
	October	210,000	44,000	3,500,000	48,000	540,000	120,000
	November	1,600,000	100,000	540,000	100,000	1,600,000	140,000
	December	49,000	9,400	350,000	58,000	110,000	75,000
St. Louis County, Missouri Central Plant	January	35,000	5,500	17,000	3,800	9,200	2,500
	February	35,000	5,900	11,000	3,600	13,000	3,800
	March	17,000	5,600	14,000	4,900	35,000	5,700
	April	13,000	3,950	14,000	5,000	35,000	9,800
	May	24,000	8,500	110,000	16,250	92,000	17,000
	June	54,000	19,700	35,000	15,500	160,000	50,000

Table 5
Page 3 of 3

		1955		1956		1957	
		Maximum	Average	Maximum	Average	Maximum	Average
St. Louis County Missouri Central Plant (Continued)	July	92,000	24,100	54,000	25,000	160,000	31,000
	August	54,000	12,400	54,000	13,800	54,000	15,000
	September	24,000	10,000	35,000	8,300	92,000	16,000
	October	54,000	12,500	13,000	6,200	160,000	24,000
	November	54,000	15,200	13,000	4,200	240,000	45,000
	December	13,000	4,100	22,000	6,100	54,000	20,000

For the three-year period of record, the monthly average coliform density exceeded 5,000 per 100 ml. 92 per cent of the time. Even for the three-year period of record, monthly average coliform density exceeded 10,000 organisms per 100 ml. 83 per cent of the time at the 6 water plants.

Since water treatment plants must be capable of meeting maximum conditions, the maximum coliform concentrations are listed. During the three-year period, all six plants experienced coliform concentrations of 1,600,000 per 100 ml. or greater.

Percentage of samples exceeding various limits in winter, summer, and intermediate seasons are depicted in Figures 1, 2, and 3. Ninety per cent of the station-seasons had densities of 20,000 per 100 ml. more than 5 per cent of the time. Ninety-four per cent of the station-seasons had coliform concentrations in excess of a 5,000 per 100 ml. more than 20 per cent of the time.

Only two stations, Omaha, Nebraska, and St. Louis County, Missouri, approach a reasonable limit of coliform concentration and then for only the winter seasons. The charts indicate the general downstream trend of bacterial pollution. Values are the lowest in winter and highest in summer.

Table 6 shows the effects of the pollution load contributed by one of the lower main stem cities. This same effect would be true of any of the major cities discharging untreated wastes. The St. Joseph, Missouri, water treatment plant is above the entrance of the city's pollution. During the period shown, water entering the water

Figure 1

PERCENT OF SAMPLES (COLIFORM)
EXCEEDING VARIOUS LIMITS

Winter Season (Dec - Feb)

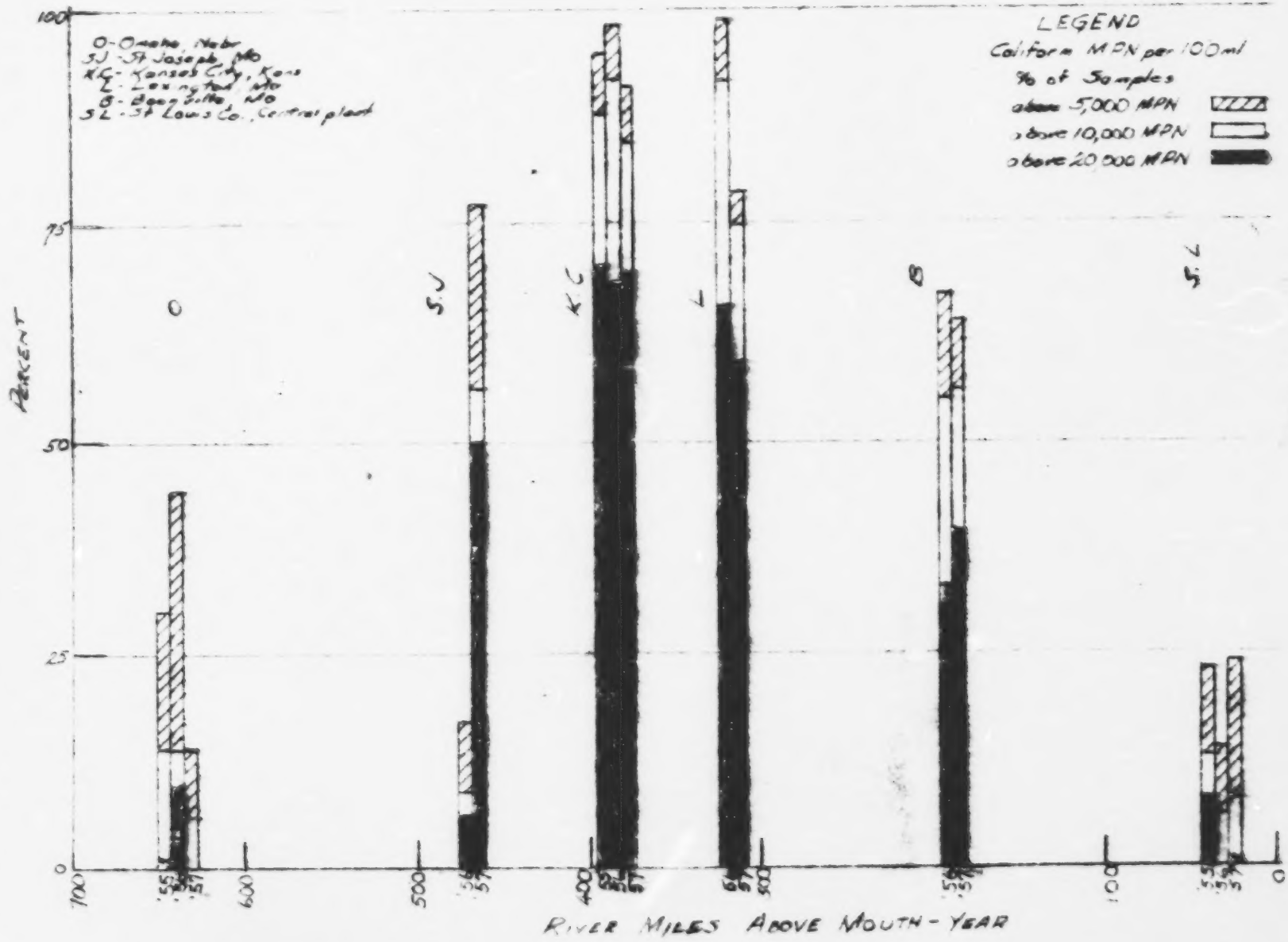


Figure 2

PERCENT OF SAMPLES (COLIFORM) EXCEEDING VARIOUS LIMITS

Intermediate Season (Mar. - May, Oct. Nov.)

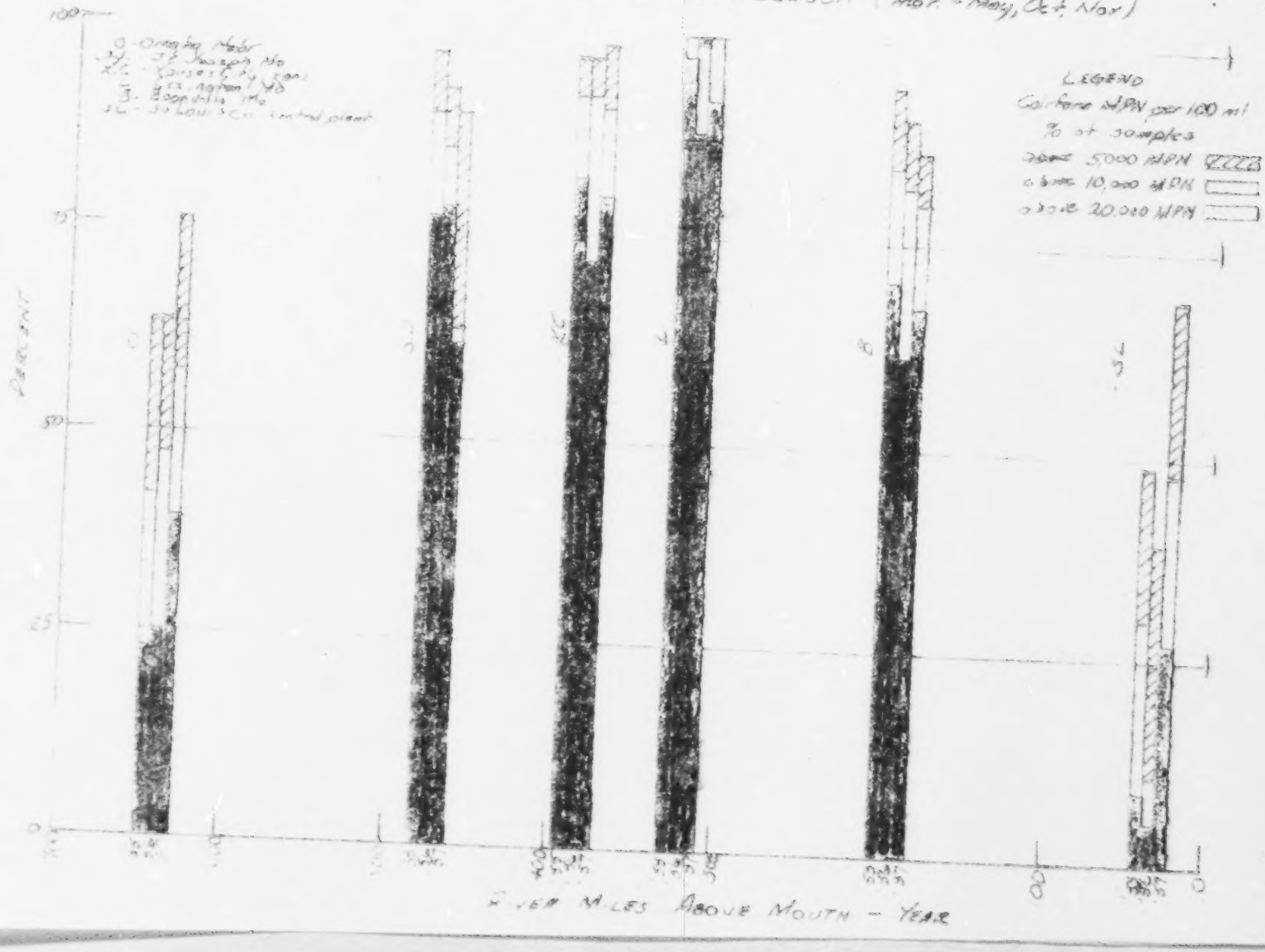


Figure 3

PERCENT OF SAMPLES (COLIFORM) EXCEEDING VARIOUS LIMITS

SUMMER SEASON (JUN-SEPT)

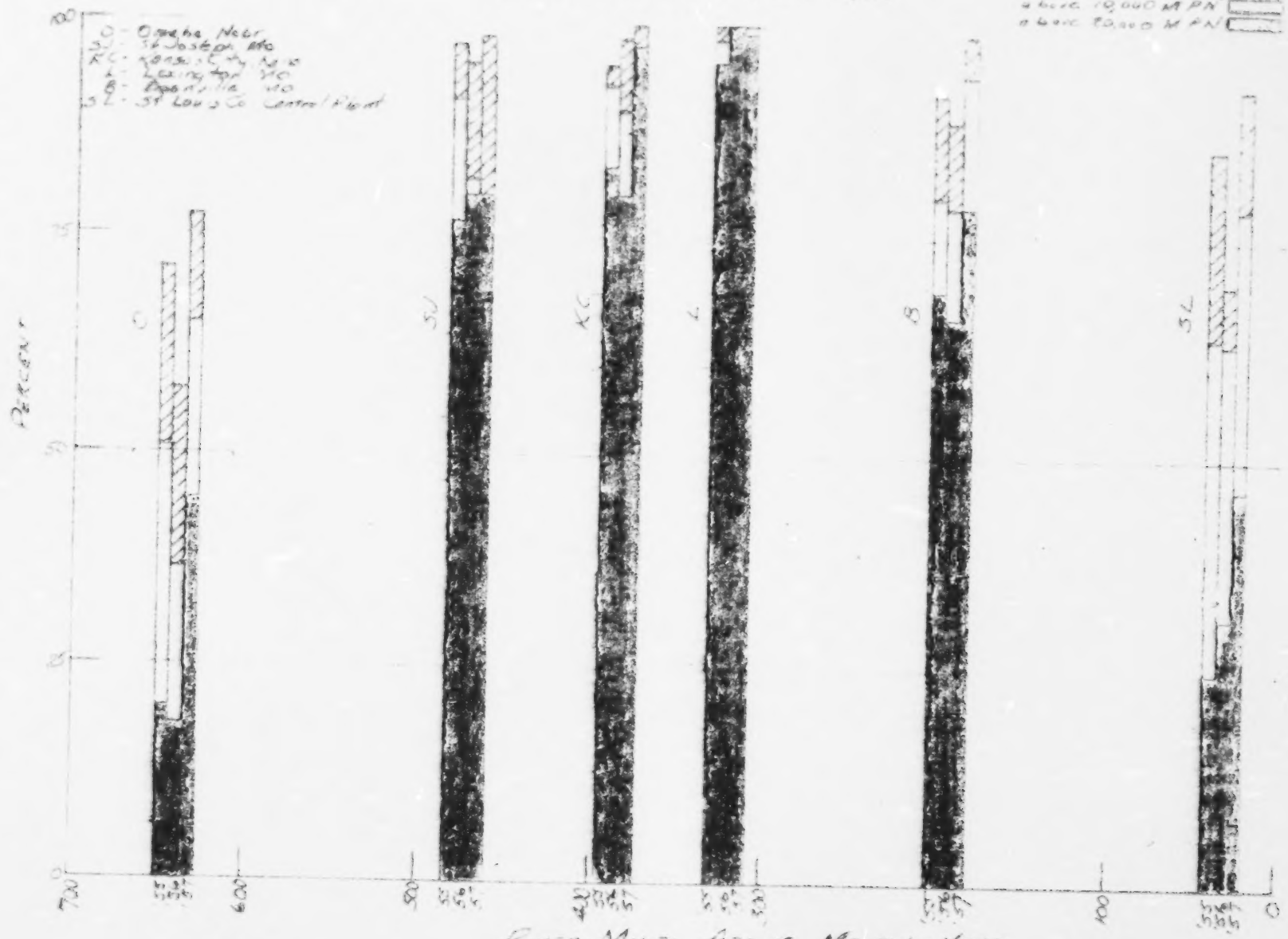


Table 6

Coliform MPN per 100 ml.

	St. Joseph, Mo., Water Plant Above Sources of Pollution	Below St. Joseph, Mo., and Sources of Pollution
August 2, 1957	9,300	43,000
8	23,000	93,000
15	9,300	23,000
25	-	93,000
September 3, 1957	43,000	23,000
9	23,000	43,000
16	2,100	43,000
23	23,000	43,000
October 7, 1957	-	24,000
14	24,000	46,000
22	24,000	46,000
27	24,000	110,000
Average	20,000	52,000

Table 7

YANKTON, SOUTH DAKOTA, WATER TREATMENT PLANT
Missouri River Raw Water
Coliform MPN per 100 ml.

Date	MPN/100 ml.	Date	MPN/100 ml.	Date	MPN/100 ml.
1-10-55	430	1-16-56	130	1- 7-57	9.1
1-26-55	43	2-13-56	110	2- 7-57	3
2- 9-55	43	2-27-56	140	3- 6-57	3
2-23-55	230	3-14-56	17	4- 8-57	3
3-14-55	930	3-27-56	22	5- 6-57	3.6
7- 7-55	9.2	4- 6-56	540	6- 5-57	3.6
7-26-55	23	4-23-56	1600	7- 9-57	930
8-10-55	>1600	5- 3-56	46	8-20-57	93
8-29-55	>1600	6-13-56	23	9- 3-57	43
9- 7-55	220	7-14-56	93	10- 7-57	15
9-14-55	>1600	8- 6-56	430	12- 5-57	3
10- 3-55	>1600	9-11-56	3.6		
10-26-55	180	10-22-56	23		
11- 1-55	130	11- 8-56	430		
11- 7-55	240	12- 6-56	3.6	Average	320
11-30-55	70				
12- 6-55	49				
12-21-55	170				

plant averaged 20,000 coliform organisms per 100 ml. Below St. Joseph, i.e., below entrance of untreated wastes, the average was 52,000 coliforms per 100 ml.

Coliform-type bacteria exhibit a definite die-off pattern, the maximum death rate occurring a short time after they are deposited in the stream. It then gradually assumes a constant level, as is shown in Figures 1 to 3.

At Yankton, South Dakota, near river mile 840 and above all major sources of pollution, no samples exceeding 5,000 coliforms per 100 milliliters have occurred during the 3 years from 1955 to 1957. As shown in Table 7, the average coliform density for the 3-year period was 320 organisms per 100 milliliters. Effects of the pollution load contributed by Sioux City, Iowa, and other smaller communities can be seen at Omaha. St. Joseph, Missouri, generally exhibited concentrations in excess of those at Omaha. The pollution load is so great that natural coliform die-off, or "self-purification" of the river, does not permit recovery. Below the Kansas Cities, recovery occurs, but not down to any reasonable level.

WATER QUALITY--SPECIAL SURVEY

Beginning in January 1958 and lasting for one month, the Public Health Service, in cooperation with water treatment plants from St. Joseph, Missouri, to Kansas City, Kansas, initiated a special study of Missouri River water quality in the reach from St. Joseph (river mile 470.5) to Kansas City, Kansas (river mile 385). Laboratory

facilities at the Atchison, Kansas, water treatment plant were made available to a Public Health Service laboratory technician from the Public Health Service Sanitary Engineering Center, Cincinnati, Ohio.

The daily sampling program timed collection at various points to coincide with time of water travel below St. Joseph, beginning with time of greatest waste contribution by that city. Determinations included dissolved oxygen, biochemical oxygen demand, and coliform type bacteria.

The average dissolved oxygen concentration remained nearly constant (range 12.52 to 12.77 ppm) at about 90 per cent saturation. Biochemical oxygen demand varied from an average of 3.11 ppm at the St. Joseph water plant to 9.64 ppm below St. Joseph. Wastes may have been incompletely mixed into the river below St. Joseph. Increase of BOD over levels found at the water treatment plant, assuming an average discharge of 14,000 cfs, indicates about 48,000 lbs. of BOD per day or a population equivalent of 2,900,000 from St. Joseph. Latest estimates place the St. Joseph waste load at approximately 650,000 P. E.

Results of the coliform analyses are shown in Fig. 4. A substantial increase evident immediately below St. Joseph was followed by a rapid die-off downstream. Effects of the St. Joseph waste load are clearly indicated.

TASTE AND ODOR

Tastes and odors have become more frequent in the Missouri River water during the past few years. In December 1957, the Public Health

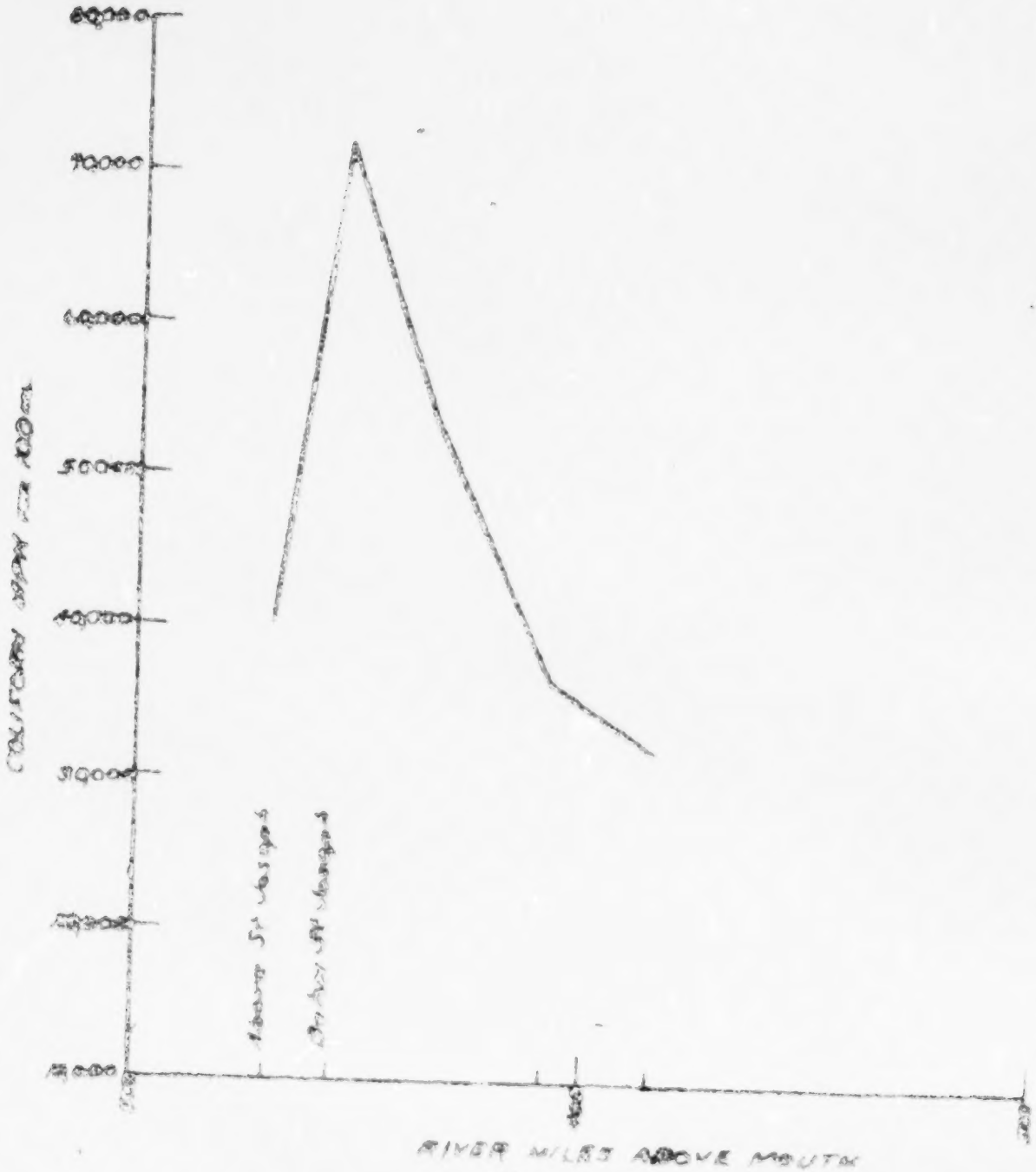
MISSOURI RIVER WATER QUALITY

AVERAGE COLIFORM DENSITY

SPECIAL SURVEY

JAN 8 to FEB 1, 1950

FIGURE A

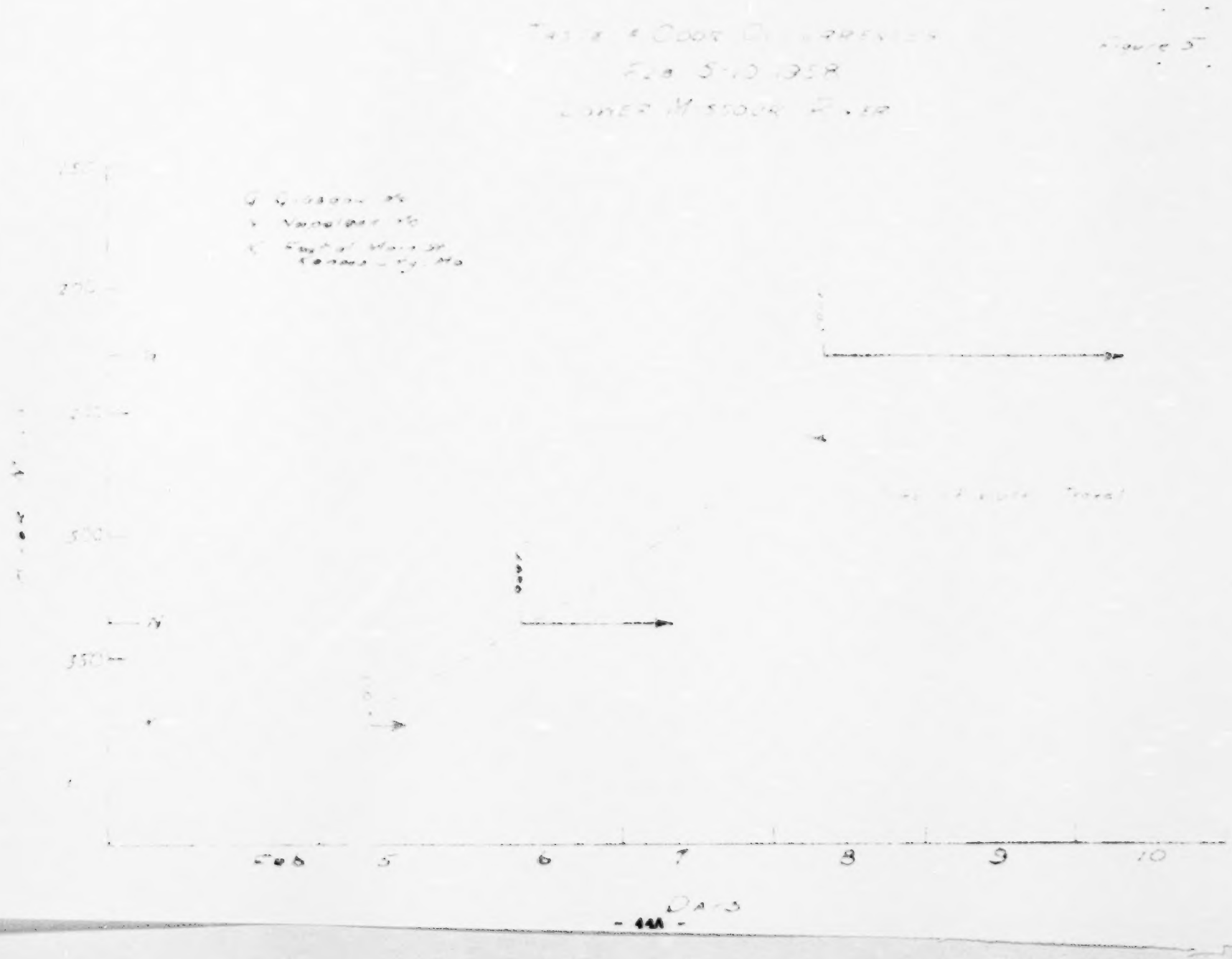


Service in cooperation with Corps of Engineer facilities, water and power production plants, began monitoring oil slicks and odor occurrences.

Observations are made routinely at the Corps of Engineers Dock, Foot of Main Street, Kansas City, Missouri, mile 377.5, the Hawthorne Power Plant, mile 369.3, the Northwest Missouri Electric Cooperative Power Plant at Missouri City, Missouri, mile 351, and the Corps of Engineers radio station at Napoleon, mile 332.4. Locations of these stations permit close delimitation of sources of obnoxious substances in the Kansas City area. Speed of downstream travel and survival time may be ascertained by additional observations that may be made at Glasgow, mile 227, and Gasconade, mile 104, upon request. Power plant personnel are on duty 24 hours a day. Observations at Corps of Engineers installations routinely correspond to periods of duty by radio operators.

Reports of various observers are summarized in Table 8. Most of the data consist of isolated observations of odors or oil slicks. Some reports can be related to others downstream. Two such instances are depicted in Figures 5 and 6.

The hour of day at which the odor or oil slick was reported and the duration of the problem are shown by the heavy line and arrowheads. Time of water travel, as computed from flow, velocity of the water and distance between the indicated points is shown by the diagonal broken line. In nearly all instances, the oil or odor persisted for a few hours after the report.


350
500
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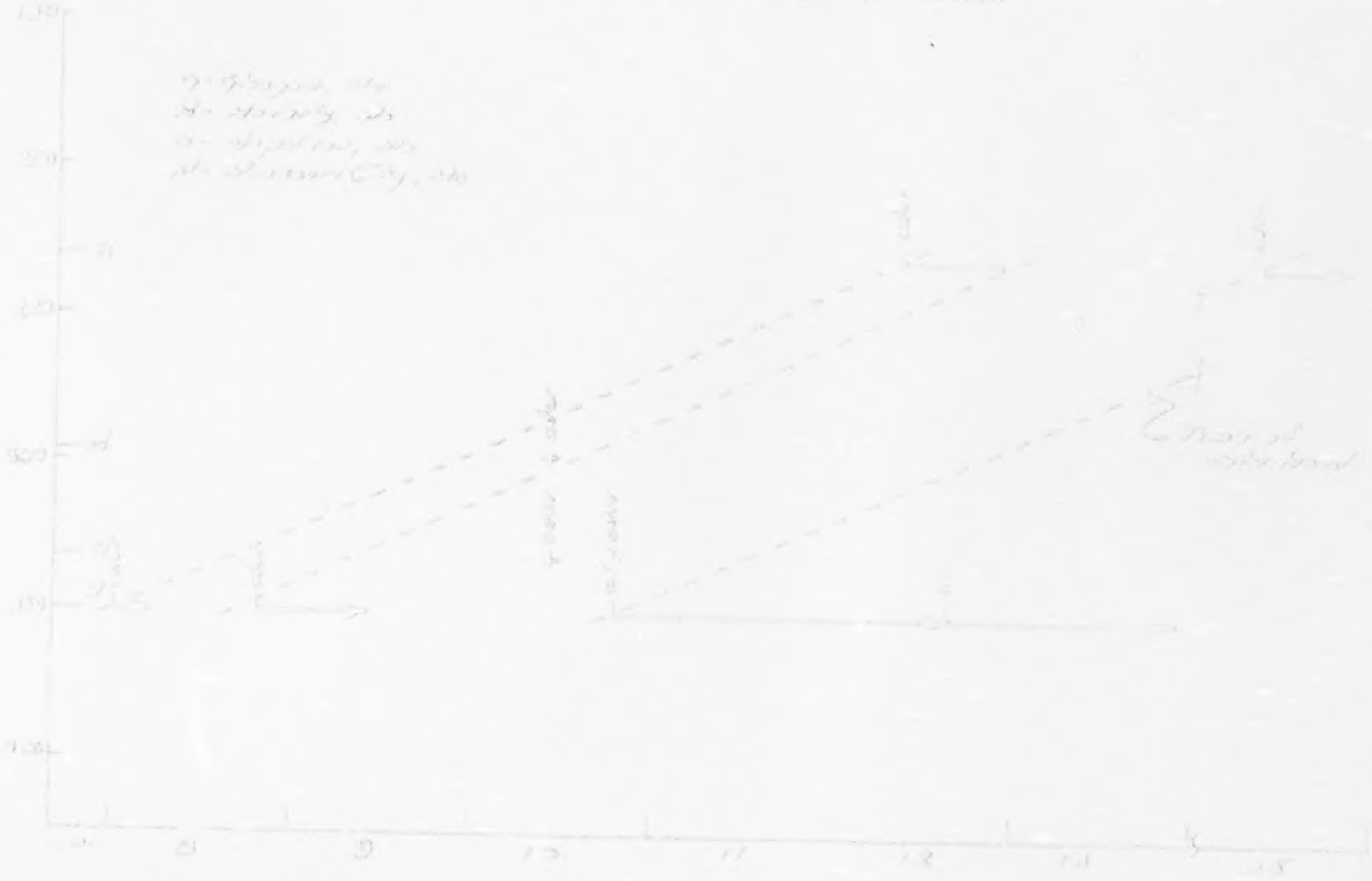

Days

LOG OF ODOR OCCURRENCES IN MISSOURI RIVER

Table 8
Page 1 of 5

Date	Time	Location	River Mile	Remarks	Approx. Discharge At K.C., Mo. (cfs)
12/ 1/57	-	Glasgow, Mo.	227	Odor noted at water treatment plant	19,000
12/14/57	-	Napoleon, Mo.	333	Odor noted	15,000
12/15/57	-	Glasgow, Mo.	227	Odor noted at water treatment plant	14,000
12/16/57	-	Napoleon, Mo.	333	Strong odor scented of rotten cabbage. Dissolved oxygen 12.8 ppm	13,000
12/16/57	-	Foot of Main St., Kansas City, Mo.	377	No odor present	13,000
12/16/57	1:30 PM	Glasgow, Mo.	227	Odor (Corps of Engineers)	13,000
12/16/57	-	Glasgow, Mo.	227	Odor noted at water treatment plant	13,000
12/17/57	-	Gasconade, Mo.	104	No odor	12,000
12/17/57	-	Glasgow, Mo.	227	Odor noted at water treatment plant	12,000
12/18/57	-	Napoleon, Mo.	333	No odor	12,000
12/18/57	-	Gasconade, Mo.	104	No odor	12,000
12/18/57	-	Washington, Mo.	68	No odor	12,000
12/18/57	-	Glasgow, Mo.	227	Odor noted at water treatment plant	12,000
12/19/57	5:30 AM	Gasconade, Mo.	104	Odor reported	19,000
12/19/57	-	Glasgow, Mo.	227	Odor noted at water treatment plant	19,000
12/20/57	-		45	Odor reported	21,000
12/20/57	11:30 PM	Foot of Main St., Kansas City, Mo.	377	Slight oil	21,000
12/21/57	2:30 PM	" " "	377	Oil on river--no odor	21,000
12/22/57	10:30 AM	" " "	377	Oil on river--no odor	21,000
12/23/57	4:00 AM	Glasgow, Mo.	227	Odor reported (Corps of Engineers)	20,000
1/ 1/58	7:00 PM	Missouri City, Mo.	351	Odor reported	17,000
1/ 2/58	1:30 PM	" " "	351	No odor	16,000
1/ 4/58	7:15 PM	" " "	351	Odor reported	9,000
1/ 8/58	12:01 AM	" " "	351	Severe odor reported	9,000
1/ 8/58	5:00 AM	" " "	351	Odor subsided	9,000
1/ 8/58	7:00 PM	" " "	351	Odor reported	9,000
1/ 9/58	8:00 AM	" " "	351	Odor and oil still present (field checked--odor present)	11,000
1/ 9/58	-	Hawthorne, Mo.	369	No odor	11,000

LOG OF ODOR OCCURRENCES IN MISSOURI RIVER

Table 8
Page 2 of 5

Date	Time	Location	River Mile	Remarks	Approx. Discharge At K.C., Mo. (cfs)
1/10/58	8:00 AM	Waverly, Mo.	297	Odor reported by Corps of Engineers	11,000
1/10/58	8:00 AM	Napoleon, Mo.	333	Odor reported by Corps of Engineers	11,000
1/10/58	6:30 PM	Missouri City, Mo.	351	Oil slick appeared	11,000
1/10/58	7:00 PM	" " "	351	Odor present	11,000
1/11/58	9:00 AM	" " "	351	Oil greatly increased severe odor	10,000
1/12/58	3:00 PM	" " "	351	Oil slick present - no odor	12,000
1/12/58	-	Glasgow, Mo.	227	Odor reported at water treatment plant	12,000
1/13/58	3:00 PM	Missouri City, Mo.	351	Oil slick still present	18,000
1/14/58	-	Glasgow, Mo.	227	Odor reported by water treatment plant	28,000
1/15/58	8:00 AM	" "	227	Odor reported (Corps of Engineers)	21,000
1/19/58	-	" "	227	Odor reported at water treatment plant	19,000
1/28/58	7:40 AM	Missouri City, Mo.	351	Oil slick - no odor	18,000
1/29/58	7:55 AM	" " "	351	Heavy oil slick present - no odor	19,000
2/ 4/58	7:45 PM	" " "	351	Odor reported--scent of rotten cabbage	15,000
2/ 5/58	AM	Foot of Main St., Kansas City, Mo.	377	Heavy oil slick--reported oil concentrated near south bank	15,000
2/ 5/58	1:00 PM	" " "	377	Oil gone	15,000
2/ 6/58	8:00 AM	Napoleon, Mo.	333	Severe odor reported	15,000
2/ 7/58	8:00 AM	" "	333	Odor still present	15,000
2/ 8/58	-	Glasgow, Mo.	227	Odor reported by water treatment plant	15,000
2/ 9/58	-	" "	227	" " " " " "	14,000
2/10/58	-	" "	227	Odor reported (Corps of Engineers)	18,000
2/17/58	2:40 PM	Missouri City, Mo.	351	Oil slick--no odor	10,000
2/19/58	8:00 AM	Foot of Main St. Kansas City, Mo.	377	Very heavy oil slick and strong odor reported	12,000
2/19/58	AM	Inter City Viaduct	279-K.3	Field checked--no oil or odor found	-
2/19/58	AM	Platte Co. Bridge	384	" " " " " "	12,000
2/19/58	AM	ASB Bridge	377	" " --Little oil and slight odor reported	12,000
2/19/58	AM	Foot of Main St., Kansas City, Mo.	377	Field checked--Little oil and slight odor reported	12,000

LOG OF ODOR OCCURRENCES IN MISSOURI RIVER

Date	Time	Location	River Mile	Remarks	Approx. Discharge At K. C., Mo. (cfs)
3/ 3/58	1:00 PM	Foot of Main St., Kansas City, Mo.	377	Oil slick--no odor	65,000
3/28/58	2:30 PM	" " "	377	Slight oil slick--no odor	26,000
4/ 2/58	9:00 AM	" " :	377	Slight oil slick--Pronounced odor	34,000
5/ 2/58	12:01 AM to 6:00 AM	Missouri City, Mo.	351	Heavy oil slick	42,000
5/21/58	8:45 AM	Foot of Main St., Kansas City, Mo.	377	Heavy oil slick	55,000
5/21/58	9:30 AM	Kansas City, Mo.	382	No oil present since daylight at waterworks	55,000
5/28/58	4:00 PM	Missouri City, Mo.	351	Odor and oil slick appeared	40,000
5/28/58	8:00 PM	" " "	351	Odor and oil slick very bad	40,000
5/31/58	12:30 AM	" " "	351	Odor appeared	40,000
5/31/58	9:30 AM	" " "	351	Odor still strong	40,000
6/16/58	12:30 AM	Missouri City, Mo.	351	Bad odor and some oil	70,000
6/17/58	3:00 AM	" " "	351	Bad odor and no oil slick	57,000
6/18/58	2:45 PM	" " "	351	Heavy oil slick	46,000
6/19/58	7:30 AM	" " "	351	Heavy oil slick	42,000
6/21/58	4:00 AM	" " "	351	Still have oil	40,000
6/21/58	7:30 AM	" " "	351	Oil dissipated	40,000
7/10/58	1:30 PM	Missouri City, Mo.	351	Heavy oil slick--very little odor	-
7/24/58	5:00 AM	" " "	351	Heavy oil slick--very little odor	77,000
7/24/58	3:00 PM	" " "	351	Oil still present	77,000
7/28/58	8:00 AM	Foot of Main St. Kansas City, Mo.	377	Oil slick present	82,000
8;14/58	12:01 AM	Missouri City, Mo.	351	Heavy odor	45,000
8/14/58	8:00 AM	" " "	351	Odor gone	45,000

LOG OF ODOR OCCURRENCES IN MISSOURI RIVER

Date	Time	Location	River Mile	Remarks	Approx. Discharge At K. C., Mo. (cfs)
9/ 2/58	6:00 AM	Missouri City, Mo.	351	Oil slick present	39,000
9/ 2/58	7:30 AM	" " "	351	Oil still present	39,000
9/ 4/58	2:30 PM	" " "	351	Heavy oil slick present	37,000
9/15/58	PM	" " "	351	Oil slick present	65,000
9/16/58	7:00 AM to 9:00 AM	" " "	351	Heavy oil slick--no odor	56,000
10/14/58	3:30 PM	Missouri City, Mo.	351	Strong odor of rotten cabbage	40,000
10/14/58	4:30 PM	" " "	351	Strong odor of rotten cabbage still present	40,000
10/15/58	8:30 AM	" " "	351	Strong odor of rotten cabbage still present--no oil slick	39,000
10/21/58	8:00 AM	" " "	351	Heavy oil slick--no odor	39,000
10/21/58	6:00 PM	" " "	351	Odor of rotten cabbage	39,000
10/21/58	7:45 PM	" " "	351	Odor of rotten cabbage--some oil present	39,000
10/24/58	-	Napoleon, Mo.	333	Rotten cabbage odor--no oil slick	38,000
10/25/58	-	" "	333	Rotten cabbage odor worse--no oil slick	38,000
10/29/58	11:00 PM	Missouri City, Mo.	351	Bad odor--no oil slick	38,000
10/30/58	8:20 AM	" " "	351	Odor continues--no oil slick	38,000
10/31/58	-	Napoleon, Mo.	333	Odor reported 10/24/58 is still present--no oil slicks. Odor worse in morning.	38,000
11/12/58	AM	Missouri City, Mo.	351	Terrible rotten cabbage odor reported	22,000
11/12/58	AM	Henrietta, Mo.		Bad odor reported	22,000
11/13/58	2:30 PM	Missouri City, Mo.	351	Medium oil slick--no odor	21,000
11/14/58	5:30 AM	" " "	351	Heavy oil slick	20,000
11/14/58	AM	" " "	351	Terrible odor reported	20,000
11/14/58	10:30 AM	" " "	351	Yellow scum	20,000
11/15/58	9:10 AM	" " "	351	Oil and scum	19,000
11/16/58	10:40 AM	" " "	351	No odor--yellow scum and oil slick	19,000
11/16/58	4:00 PM	" " "	351	No odor--yellow scum and oil slick still present	19,000
11/17/58	AM	" " "	351	Still a scum and quite a bit of oil	22,000
11/24/58	4:00 PM	" " "	351	Heavy odor--oil is not too heavy	22,000

LOG OF ODOR OCCURRENCES IN MISSOURI RIVER

Date	Time	Location	River Mile	Remarks	Approx. Discharge At K. C., Mo. (cfs)
12/ 4/58	8:00 AM	Missouri City, Mo.	351	Bad oil slick--no odor	15,000
12/12/58	8:00 AM	Napoleon, Mo.	333	Odor reported--persisted through last 3 days	9,000
12/13/58	8:45 PM	Missouri City, Mo.	351	Very strong odor of rotten cabbage	
12/18/58	3:00 PM	" " "	351	Light oil scum	

Figure 5 depicts an occurrence starting at the foot of Main Street in Kansas City and extending to Napoleon and Glasgow, Missouri. Oil was reported on February 5, 1958, at the foot of Main Street. An odor was reported 24 hours later at Napoleon, Missouri, the time of water travel between the two points being approximately 29 hours. Odor was reported at Glasgow February 8, 72 hours after it appeared at the foot of Main Street in Kansas City. Theoretical time of travel between Kansas City and Glasgow was approximately 91 hours. Figure 6 depicts two occurrences in January of 1958, one beginning on January 8 at Missouri City, the other on January 10 at the same location.

Water plant reports of taste and odor difficulties indicate occurrence of egg shells, feathers, grease balls, condoms, and other items floating on filters and settling basins. Operation of these plants has stopped at times to allow "slugs" of highly polluted material, oils, sewage, etc., to pass the water intakes.14/

Organic Chemicals

In October 1957, a program for extraction of organic materials important in taste and odor problems in the Missouri River was initiated. These organics occur in minute quantities, and are collected by passing water through a filter containing activated carbon. Organic materials absorbed by the carbon are then removed by use of various solvents in extraction processes.

14/ See transcripts of conferences, Omaha, Nebraska, St. Joseph, Missouri, and Kansas City Metropolitan area, dated June 14, 1957, June 11, 1957, and December 3, 1957, respectively.

Extraction was performed by water plants at Omaha, Nebraska, Kansas City, Missouri, St. Louis County, and St. Louis City; and detailed analyses were carried out in the Sanitary Engineering Laboratories of Washington University, St. Louis, Missouri. A Washington University report entitled "Report of Progress on Laboratory Investigations of Organic Extracts from the Missouri River", covering the sampling period October 20, 1957, to March 17, 1958, was issued in June 1958. Some conclusions were:

1. "The potential of chlorogorm soluble organisms to cause odor increases as one proceeds downstream on the Missouri River from Yankton to St. Louis.
2. "The chloroform soluble organics in the Missouri River generally increase downstream from the metropolitan areas of Omaha, St. Joseph, Kansas City, Lexington, and Jefferson City.
3. "The Missouri River is accumulating odor substances from pollutants introduced at metropolitan and industrial areas.
4. "The chloroform soluble organic groups were not significantly reduced by water treatment processes and in many instances the present methods of purifying water increased the weight of chloroform soluble organic materials."

A PHS report, "Carbon Filter Monitoring Results, Lower Missouri River Water Quality Study", July 11, 1958, incorporates data assembled over the period January 1--May 26, 1958. This report points out variables that affect results, chiefly, sewage and industrial waste discharges, organics contributed by land drainage, river discharge, and biological activity.

Figures 7, 8, and 9 show the relationship of flow to chloroform extractables. Conclusions substantiate the earlier Washington University report. The report recommended establishment of additional carbon filters on the main stem and tributaries, and pointed out the program value in providing a reference against which the river's chloroform soluble organics can be judged in future years.

POLLUTION AND ITS EFFECTS

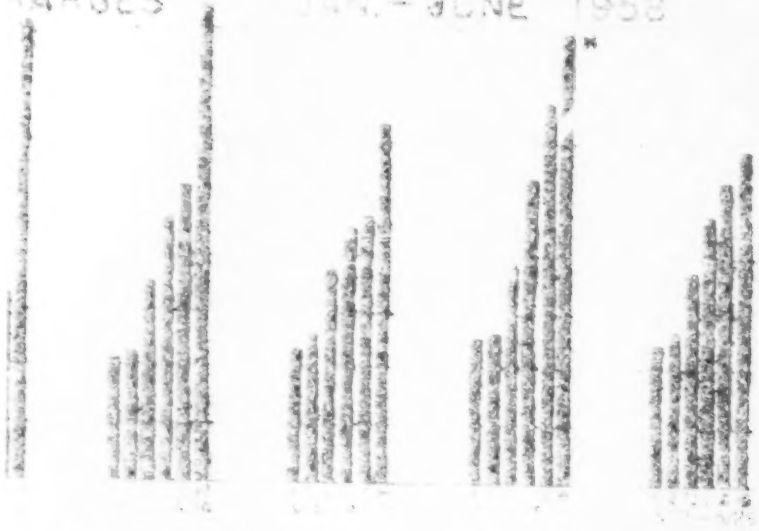
Table 5 lists pollutional loads contributed by communities considered in this report. It will be noted that some small communities located on or near the main stem are omitted. These communities either provide treatment or discharge their wastes to tributaries a short distance from the main stem.

Data on progress toward sewage treatment by lower main stem communities are also listed in Table 9. Two-thirds of the communities have completed, or have under preparation, preliminary engineering reports on sewage treatment. However, only one-half of the communities are making adequate progress toward actual construction of treatment facilities. While some of the communities have had

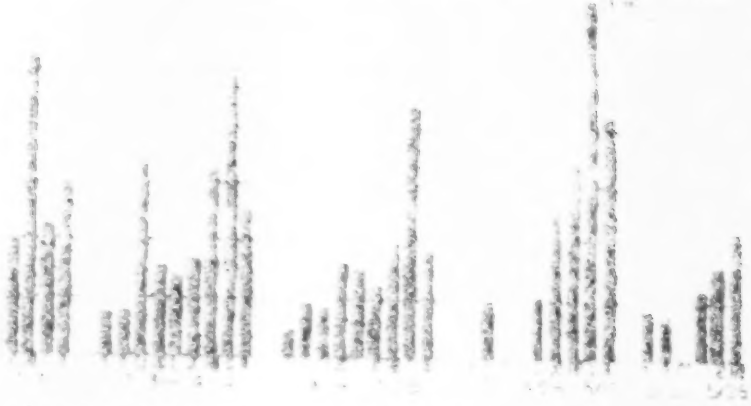
Table 9

	Untreated Wastes	Progress Toward Sewage Treatment			
	Population Equivalents	Pre. Eng. Report	Arranged Financing	Applied for Federal Grant	Started Construction
Yankton, South Dakota	11,500	x		x	
Elk Point, South Dakota	1,350	x	x	x	x
South Sioux City, Nebraska	3,500				
Sioux City, Iowa	521,400	x			
Dakota City, Nebraska	-				
Blair, Nebraska	3,290	x	x	x	x
Carter Lake, Iowa	600				
Council Bluffs, Iowa	47,150	x			
Omaha, Nebraska	1,570,020	x	Partial	Partial	Partial
Bellevue, Nebraska	2,000	x			
Plattsmouth, Nebraska	25,410	x			
Nebraska City, Nebraska	19,200	x			
St. Joseph, Missouri	645,700	x			
Atchison, Kansas	30,000	x	x		
Leavenworth, Kansas	24,390	x			
Wadsworth, Kansas	5,000				
Kansas City, Kansas	832,800	x			
North Kansas City, Missouri	137,500	x			
Kansas City, Missouri	844,330	x			
Independence, Missouri	23,400	x	x	x	
Lexington, Missouri	2,350				
Waverly, Missouri	540				
Glasgow, Missouri	850				
Boonville, Missouri	5,470				
Jefferson City, Missouri	25,600	x			
Hermann, Missouri	3,300				
Washington, Missouri	6,970	x			
St. Charles, Missouri	14,970	x			
St. Louis County, Missouri	90,000	x			

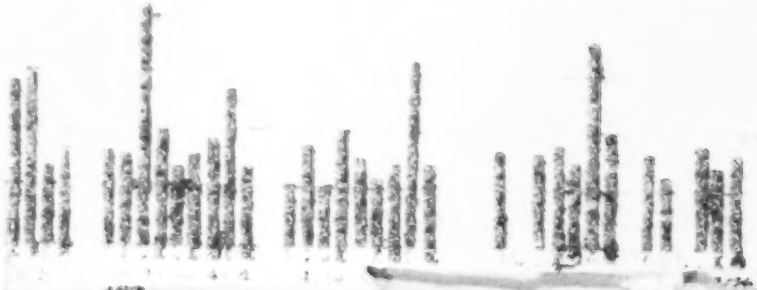
CHARGES JAN. - JUNE 1958 FIG 1



EXTRACTABLES (LBS/D[illegible] JAN. JUNE 1958 FIG 2



EXTRACTABLES (PPB) JAN - JUNE 1958 FIG 3



reports prepared or have done work toward construction, their plans are presently inactive and indicate inadequate progress.

INTERSTATE POLLUTION CONFERENCES

Under provisions of the Federal Water Pollution Control Act (Public Law 660) four conferences have been held.

Sioux City, Iowa, Area	July 24, 1958
Omaha, Nebraska, Area	June 14, 1957
St. Joseph, Missouri, Area	June 11, 1957
Kansas City, Missouri, Metropolitan Area	December 3, 1957
St. Louis, Missouri, Metropolitan Area	March 4, 1958

The Act provides that pollution of interstate waters which endangers the health or welfare of persons in a State other than the one in which the discharge originates is subject to abatement under the procedures described in Section 8. It was upon this basis that the conferences, the first step in the procedure, were called.

The conferences were called for the purpose of bringing the States and Public Health Service together to develop a basis for future action by all parties concerned, and to give the States and localities an opportunity to take any remedial action which may be indicated under State and local law.

At all of the conferences with the exception of Sioux City, it was agreed between conferees and city officials that interstate pollution as defined by the Federal Water Pollution Act, did exist. However, at the Sioux City conference, city spokesmen stated that (1) the city was not polluting the river and endangering health or welfare, and

(2) that the city would not proceed further with construction because it would not be economically feasible. The city declined from presenting information contrary to the data presented at the conference, nor were data presented to substantiate the city's contention.

Time schedules for remedial action were established by the conferees at all the conferences and are contained in the official transcripts and summaries. Briefly, target dates for award of final contracts are: St. Joseph, Missouri, January 1, 1959; Omaha, Nebraska, January 1, 1960; Kansas City, Kansas, March 1, 1960; Kansas City, Missouri, March 1, 1960; North Kansas City, Missouri, September 1, 1960; Sioux City, Iowa, January 1, 1961.

Bibliography

Lower Missouri River Basin, Water Pollution Investigation, October 1952 (PHS Publication No. 269)

A Comprehensive Program for Control of Water Pollution--Missouri Drainage Basin, July 1953 (PHS Publication No. 317)

Federal Water Pollution Control Act, Public Law 660--84th Congress

Employment and Earnings, Annual Supplement Issues, May 1955, July 1958.

Carbon Filter Monitoring Results--Lower Missouri Water Quality Study, July 11, 1958

Transcripts and Summaries of Conferences, Pollution of Interstate Waters

St. Joseph, Missouri	June 11, 1957
Omaha, Nebraska	June 14, 1957
Kansas City, Missouri, Metropolitan Area	December 3, 1957
St. Louis, Missouri, Metropolitan Area	March 4, 1958
Sioux City, Iowa	July 24, 1958